INTRODUCTION
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Pollen and spores are the major organic constituents of atmosphere. The harmful effect caused by their presence in the atmosphere has induced many scientists abroad as well as many in India to take up aerobiological investigation problems. The probable benefits that can be derived are multifold, in developing country like India, from investigations in the field of aerobiology. Several lines of research programme have been successfully pursued namely,

1) Production and dispersal biology of pollen grains and fungal spores.
2) Floristic survey and pollination ecology
3) Analysis of pollen and fungal spore antigens and study their clinical significance.
4) Biochemical aspects of pollen/spore allergens.
5) Storage microbiology.
6) Aerobiology and plant pathology in relation to microbial pollution and their relevance to diseases of crop plants in field and diurnal storage.
7) Handling of occupational and airborne diseases.
8) Techniques pertaining to trapping of airborne particles.

The term aerobiology was coined already in the 1930's to embrace studies of fungus spores, pollen grains and bacteria in the atmosphere. The scope of aerobiology has later been widened to include various other biological particulates
(airspora) e.g. viruses, algae, fungi, linen fragments (Soredia), spores, pollen, seeds, plant propagules, protozoa (cysts), minute insects and so forth. Abiotic particulates or gases affecting living organisms are currently included in concept of aerobiology (Nilsson, 1981).

The size of airspora varies from Ca. 0.02 m (or less) in viruses to 100 m or several centimeters (Edmonds, 1979). Airborne biological particles are also named aeroplankton to denote containing floating dusty particulates are called aerosols.

The aerobiological process (Frinking and Risdijk, 1977) comprises five main steps: Source, release, flight, deposition and impact. Each step is affected by environmental factors.

Aerobiology is a typical interdisciplinary subject with numerous aspects and characterized by continuous interrelations between the biological components and their physical and chemical environment. For practical purpose aerobiology can be divided into intramural (indoors) and extramural (outdoors) aerobiology.

As aerobiology is a discipline focussed on the atmospheric transport of microorganisms responsible for such diseases with ultimate aim of providing insight into disease control and is also known as microbiology of atmosphere.
In present era of increasing industrialization, vehicular transport, we are facing health hazard due to polluted air, smoke and adsorption/desorption of heavy metals in environment. The air in metropolitan cities is choking and offensive with particulates level enough to cause the health concern. The 'pollution' has been subject of more than 200 seminars and symposia in past ten years and practically every citizen is becoming conscious of degradation in his surrounding.

If food is spoiled and smells, one can refuse to eat it; if water is impure, one can reject to drink; but if the air is polluted, one cannot stop breathing, one has to inhale it whether it is pure or impure for survival.

On an average human being can live five weeks without food, five days without water, but hardly for five minutes without air. Each day he normally requires about 1.27 kg of food, 2.04 kg of water, but 13.6 kg of air (Agarwal and Ghosh, 1972).

The biologically important pollutants of atmosphere include pollen fungal spores, insects etc. The pollen and fungal spores together have enormous importance in inciting the disorders in human being which is a growing concern of human health hazards.
The knowledge of microbiology of atmosphere antedates to the observations of Lucretius, who had observed the scintillation of dust and other particles in a sun-beam in darkened room in 50 B.C. But, more than 1500 years have elapsed, since man began to be aware that the air around teams with myriads of microscopic living organisms. It is with the invention of simple magnifying lenses devised by Anton Van Leeuwenhoek that dynamic nature of air pulsating with the presence of life was definitely proved in the early 17th century, which also led to the establishment of the presence of minute organisms in the air by the end of 18th century. However the experiments to study the role of micro-organisms in the atmosphere was seldom attempted and remained obscure for a longer time. It is after a long gap Louis Pasteur (1861) while stating his "germ theory of diseases", demonstrated the existence of definite community of living entities in the air and proved that air is carrier of many germs.

Salisbury (1866) studied the airspora in connection with malaria in Mississippi valleys by exposing glass sheets and since then data and the information regarding the nature and composition of airspora began to accumulate. Ehrenberg (1872) first published report on micro-organisms collected from the atmosphere. However, Cunningham (1873) was the first who initiated an analytical approach to the micro-
organic components of air over Calcutta Jail in India. It is with the experiments of Miquel (1883) the experimental aerobiology started, and he elaborated the techniques to analyse the microbial contents of the atmosphere. Probably he was the first person to conduct the long term experiments to study the microbial components of the atmosphere by volumetric method. Other important contribution reported during this period were those of Frankland (1886 and 1887), who was the first to study the effect of aerodynamics on the airspora and also stated that aerodynamic effects are of major importance in devising the techniques for trapping the air-borne particles. It is in the beginning of present century Saito (1904 and 1922) in Japan, Buller and Low (1911) in Canada applied various methods to study the components of airspora. However, credit goes to Meier et al. (1933) of United States and Stepenov (1935) of Soviet Russia for establishing the subject of microbiology of the atmosphere as special discipline. Since then this branch of science concerning the atmosphere started gaining interest and importance and by the mid of century a flurry of contributions period in from the research workers from different corners of world.

The term Aerobiology was introduced in 1930's by Meier of U.S. Department of Agriculture and Gregory (1952) proposed the term Airspora to describe airborne pollen
grain and fungal spore, the composition of which varies from place to place.

Aerobiology is a branch of science which draws information from various disciplines like ecology, mycology, and plant pathology, palynology, bio-chemistry, immunology and clinical medicine.

The aerobiological investigations are broadly classified into two categories depending upon the nature of place of investigation. If the aerobiological experiments are conducted inside the buildings or in a rather closed atmosphere for the detection and trapping of the air-borne biologically significant organisms or particles, then it is called the indoor or intramural aerobiology. If the investigations are carried out in the outdoor air for the detection and trapping of the air-borne microorganisms present in the atmosphere then it is called as the 'out-door or extramural aerobiology'.

The practical utility of investigating the indoor atmosphere is to detect the various organisms present inside the buildings like dwellings, libraries, ware-houses, cattle shed, sheep sheds, poultry, vegetable markets, fruit markets and cinema halls etc. which are harmful or detrimental to very living of human beings; the books, storage grains, animals, poultry, vegetables, fruits respectively.
Investigating the outdoor atmosphere for the detection of the microorganisms present in the outdoor atmosphere has got manifold practical significance and utility. The aerobiological investigations of outdoor atmosphere involve the experiments conducted for the detection of the aeroallergenic pollen, fungal spores, and other biologically significant particles which have their impact on human health as a part of the general aerobiology experiments. Another important and widely known aspect of conducting aerobiological experiments in the outdoor atmosphere is the aerobiological investigations involving the detection and trapping of the significant plant pathogenic airborne fungi over several crop fields which is ultimately helpful in formulating a better and efficient forecasting system.

However, many workers have focussed their attention in conducting the experiment of outdoor atmosphere and in particular aeromycological surveys, general as well as aeromycology in relation to phyto-pathological problems.

Many of scientists or aerobiologists were engaged in conducting the aeromycological experiments and it forms the major part of this branch, aerobiology.

**Aerobiology abroad and in India**

The aerobiological investigations have been carried out extensively and in detail in the countries like United Kingdom,
U.S.A., New Zealand, Australia, Canada, etc. since the beginning in the early 1940's. In India it is fairly a new branch and has attained national importance and taken up by many scientists and enthusiastic workers from the beginning of 1960's.

Bernstein and Feinberg (1942) conducted a five year survey of the daily fungal spore components of the air over Chicago. Harsh and Allen (1945) studied the fungal spore contaminants of the air, Gregory (1945 and onwards) in the United Kingdom; Hyde and Williams (1949) studied a census of mould spores in atmosphere of Cardiff. Ambler and Vernon (1951) studied the atmospheric spore load with reference to the mould spores in the Auckland city and suburban area. Dye and Vernon (1952) conducted a two years survey for the airborne mould spores at 23 different localities in New Zealand. Hirst (1952 and onwards) in United Kingdom, Ainsworth (1952) studied incidence of airborne Cladosporium in the London region. Williams and Best (1955) reported atmospheric mould counts in Toronto (Canada); Di-Meena (1955) studied the airspora of Dunedin (New Zealand); Cammack (1955) studied the seasonal changes in the airspora components of southern Nigeria; Pady, Kramer and his co-workers (1957 and onwards) in United States; Meredith (1961 and onwards) in West Indies. Davies et al. (1963) studied the comparison between the summer and autumn airspora at
London and Liverpool. Rees (1964) studied the airspora of Brisbane. Shapiro et al. (1965) studied the importance of field studies and meteorological factors in mould surveys of Southern California. Milton Dworin (1966) conducted a study of atmospheric mould spores in Tucson, Arizona. Faria (1967) studied the airborne fungi in the city of Belo Horizonte, Minas Gerais (Brazil). Bartzokas (1975) studied the relationship between the meteorological parameters and airborne fungal flora of Athens metropolitan area. Moustafa and Kamel (1976) studied the fungal population in the atmosphere of Kuwait.

Harire et al. (1978) studied the airborne fungal spores in Hawz (Iran). Calvo et al. (1979 and onwards) reported the airborne fungi in the air of Barcelona (Spain). Pennycook (1980) surveyed the airspora of the Auckland city (New Zealand). Ramirez et al. (1980) reported the airspora components of Madrid (Spain).

Apart from the above mentioned wide range of investigations, studies of Gregory and Hirst (1957) on airspora at Rothamsted, Harpenden, Dransfield (1966) on airspora of Samaru; Turner (1966) on airspora of Hongkong; Long and Kramer (1972) on airspora of two contrasting sites in Kansas; Chaweewan Bunnay et al. (1982) on comparative study of the incidence of indoor and outdoor mould spores in Bangkok (Thailand) are also significant. Other noteworthy
contributions on aeromycological studies were of Rooks and Shapiro (1958) in Iowa; Barlow (1963) in Southern and Central Ontario; Derrick and Mehennan (1963 and 1966) in Melbourne (Victoria, Australia); Goodman et al. (1965) in Phoenix metropolitan area; Meredith (1965) and 1966 in Nebraska; Hirst et al. (1967) on the airspora over the sea; Wilding (1970) on the airspora of Berkshire; Papavassiliou and Bartzokas (1975) on atmospheric fungal flora of the Athens metropolitan area; Street and Hamburger (1976) on atmospheric spore sampling in San Diego, California; Lehtimaki (1977) in Finland; Finegold (1975) in Southeast Florida; Yousef-Al-Doory et al. (1980) in Washington; McDonald and Odriscoll (1980) in Ireland; Krgysztofik (1983) on the fungal flora existing in atmospheric air of Warsaw (Poland); Ivavolaric-Mr-Sic (1983) on the spores studied in two seaside towns related to aerobiological features in Croatia (Yugoslavia); Ayaaru (1983) on the airspora of an urban and suburban stations in Southern Nigeria; Allit (1984) on the venturiaceous spores in the air at Cambridge (England).

The US/IBP Aerobiology Programme was initiated in 1964 which provided cohesive framework by placing aerobiology in a system analysis framework where each particle is considered with respect to its source, release and dispersion in the atmosphere, deposition in its impact on the object. This work culminated in 1974 when the International Association
for Aerobiology was formed under the auspices of the International Union of Biological Sciences. At present IAA is the biggest international integration of Aerobiologists. It organizes international conferences at every four years. It also publishes the International Aerobiology Newsletters twice in a year, which provides us with the information on the recent researches in aerobiology from all over the world. Its first conference was organised in 1978 at Munich (West Germany), second in 1982 at Seattle (U.S.A.) and the third held at Basel (Sweden) in August 1986.

In India, the credit of initiating this branch of research goes to Cunningham (1873) for his aerobiological investigations in Calcutta Jail. He published his comprehensive work in the form of a book entitled "Microscopic Examination of Air", which perhaps happened to be the first writing on aerobiology in India. Since then there was a long stretch of gap, until the investigations of Mehta (1933, 1940 and 1952). The bulk of the work done since the early 1960's was with particular reference to aeromycology. Even in India, many plant pathologists started conducting experiments in these lines in order to understand the phytopathogenic fungal spores concentrations in the atmosphere and their role in causing epiphytotics.

Important aeromycological surveys in India were of Sreeramulu et al. (1958 and onwards) at Pentapadu in
Andhra Pradesh, Tilak and his co-workers (1970 and onwards) at Aurangabad in Maharashtra, Shenoi and Ramalingam (1976) at Mysore, Subba Reddi (1975 and onwards) at Waltair, Kamal et al. (1975) at Gorakhpur in Uttar Pradesh. Apart from them, the other noteworthy contributions are those of Rajan et al. (1952) on the study of the atmospheric fungal flora of Kanpur; Shivpuri et al. (1969) and Agrawal et al. (1974) on the atmospheric fungal spores at Delhi; Kala and Gaur (1982) at Gopeshwar township located near the western Himalaya (U.P.); Rajiv Kumar (1983) on the aeromycoflora at Dehradun city; Krishnamoorthy and Vittal (1983) on the airborne fungi of Madras city.

Maharashtra is one of the leading states for the pioneering researches in the fields of aerobiology. Karla and Dumbray (1957) conducted the survey of composition of airspora in Poona and reported 64 spore types, perhaps the experiments were not volumetric in nature and the survey was done with horizontal slides. Karnik (1962) used vaseline coated slides for the study of airspora of Jalgaon.

Chaubal and Devidkar (1964) reported spore types by the same method as was used by Karnik. Chitaley and Bajaj (1973, 1974 and 1975) have carried out studies at high altitudes at Nagpur.

In fact, Aurangabad is one of the most important aerobiology centres not only in India, but elsewhere in the
world. It could be said without hesitation that Aurangabad is the most important centre in India where a huge data of general aeromycology and in relation to plant pathology has been obtained under the stewardship of the President of Indian Aerobiological Society, Tilak (1970 and onwards) along with his co-workers. Tilak with his large and sturdy group of aerobiologists has been contributing meticulously which is undoubtedly important for the country like ours where better and efficient forecasting system for all the crops is necessary and need of the hour.

Although Indian aerobiologists have been contributing from various centres, it has culminated in the form of a society, when the Indian Aerobiological Society was formed at the time of workshop on Aerobiology (1980) at the Bose Institute in Calcutta. The Society decided to conduct the national convention at every two years' interval. Since then, the Society has organised three national conferences. The first national conference was successfully organised in 1981 at Marathwada University, Aurangabad, where a large number of budding aerobiologists had gathered and presented their observations with the eminent aerobiologists of India. The second conference was held in Lucknow in 1984 and the third conference was held at Kalyan (Bombay) in 1985. The Society also brings out a Newsletter which is published twice in a year. The Newsletter carries the reports from
various centres in India and it is most useful and essential for the young aerobiologists to get acquainted with the recent trends and developments in the field.

**Aerobiology in relation to plant pathology:**

Majority of plant pathogens which cause diseases are airborne. The impact of plant disease epidemic is enormous and these have far reaching social implications (Tilak, 1984). The role of aerobiology in detecting the source, release, dispersion and impact on the plant surfaces of plant pathogenic fungal spores has long been established. Certain plant pathogenic fungal spores travel for longer distances without losing their viability in initiating the infection and ultimate spread of the disease. This is known as the long distance transport of the pathogenic fungal spores. Travel of the fungal spores is an important consideration in the plant diseases, as certain pathogens travel for longer distances and are thus capable of carrying diseases in different places of the country. Certain fungal spores travel for shorter distances and are capable of initiating infection, but if they travel beyond the boundary line, they start losing their viability to cause infection. This type of transport is known as 'short distance transport' of fungal spores.
The importance of aerobiology in plant pathology has been proved and started with investigation of Stakman and Christensen (1946) who made an intensive study and established the relationship between the aerobiology and plant diseases and emphasised its role in forecasting the diseases and ultimate disease control. Anderson et al. (1947) studied the factors affecting infectivity, spread and persistence of *Pyricularia oryzae*.

The credit of studying the airspora in relation to phytopathological problems in detail goes to Cammack (1958) who reported on factors affecting infection gradients for a point source of *Puccinia polypora* Undrew and understood the airborne disease problem in Africa. Investigations of Kuribayashi et al. (1952) and Suzuki (1969) on airspora over rice fields in Japan were proved to be important and served in forecasting the outbreak of rice blast disease. Based upon the data of the above workers, Kiyosawa (1972) was successful in establishing a mathematical curve of disease increase and proposed an improved technique for forecasting blast development.

Apart from the investigations of the above workers, other important contributions are from Last (1955) who studied the airspora within and above the mildew infected cereal crops; Berger (1970) investigated the epidemiology of *Helminthosporium* of Florida sweet corn. He revealed that
spores became freely airborne and after release proved the importance of spore catches to be valuable in determining the threat of sweet corn during all seasons in Florida.

Other important investigations were of Meredith (1966, 1970 and 1971), Pady et al. (1956, 1965 and 1970), Burleigh et al. (1969) and Jack et al. (1974), the results of which were ultimately successfully used in adapting control measures for various plant diseases in the United States. Certain other noteworthy contributions were those of Carter (1957) - airborne pathogen of Prunus in South Australia; Meredith (1962), Lawrence and Meredith (1970) - airspora data on banana plantations in Jamaica; Waggoner (1973) studied the removal of Helminthosporium maydis spores by the wind; Wallin and Loonan (1974) sampled the airborne spores of Helminthosporium maydis among and above the corn fields at Amea, Iowa; Pow et al. (1977) studied the dispersal of airborne Fusarium oxysporum spores in the tomato green house in Ohio and Ontario, Canada; Oaka and Kommecahal (1977) monitored the airborne population of Fusarium moniliforme in corn field; Langenberg et al. (1977) studied the trends in weather variables, leafblight and number of airborne spores of Alternaria dauci over a carrot field; Strandberg (1977) studied the spore production and dispersal of Alternaria dauci in a green house and on open field of carrot; Chastagner et al. (1978) studied the dispersal of conidia of
Botrytis cinerea in tomato fields; Sanders and Snow (1978) reported the dispersal of airborne spores of boll-rotting fungi and the incidence of cotton boll-rot at several locations in Louisiana; Conture and Sutton (1978) reported the relation of weather variables and host factors to incidence of airborne spores of Bipolaris sorokiniana over a barley field in Ontario, Canada; Sutton et al. (1978) reported the relationship between the weather variables and host factors to incidence of airborne spores of Botrytis squamosa in Ontario, Canada; Jones and Duncan (1979) on airborne population of Aspergillus flavus in irrigated and non-irrigated corn fields; Hartill (1980) studied the aerobiology of Sclerotinia sclerotiorum and Botrytis cinerea spores over tobacco crops in New Zealand; Leach (1980) studied the influence of humidity and other factors on the spore discharge by Pyricularia oryzae, Drechslera maidiae and Drechslera turica; Sutton (1981) studied the production and dispersal of ascospores and conidia of Physalospora obtusa and Botryosphaeria dothidea in orchards.

Mention may be made of the work done by Roelfs (1972), Eversmeyer et al. (1973), Eversmeyer and Kramer (1975), Cohen and Sherman (1977).

In India, studies in airspora in relation to phytopathological problems have initiated by Mehta (1940) of Agra College, Agra. Mehta's (1933, 1940 and 1952) contributions
in this context is noteworthy. He conducted the experiments with his classical aerooscope and trapped the uredospores of three rusts of wheat and barley. For detecting the transport of the rust inoculum (Uredospores) from hills to plain, he conducted the experiments at different altitudes in different parts of the country and obtained the data from the 62 stations where the experiments were conducted. He further concluded that the rust survive on straw and self sown wheat plants as well as on grass hosts on hills which ultimately transport to the plains acting as the primary inoculum there. He suggested the complete replacement of wheat crop by some other crops or growing rust resistant wheat varieties. The finding proved to be a milestone in solving the rust problem in India.

Since the beginning of the investigations of Mehta, many workers have come forward to conduct the experiments over various corn fields. Some of the important contributions are from Padmanabhan (1953) who reported that the conidia of Helminthosporium oryzae present in the atmosphere acted as primary inoculum to cause the disease over paddy in Cuttack. He studied the incidence of these spores in the air over paddy fields with the help of aerooscopic experiments. Konger and Baruah (1958) reported the airborne fungal spores over a potato field. Sreeramulu and Sheshavataram (1962) studied the spore content of air over paddy fields near
Pentapadu in Andhra Pradesh. Sengupta and Chattopadhyaya (1963) reported the prevalence of airborne conidia of *Helminthosporium oryzae* over paddy fields near Chinsurah. Agarwal and Gupta (1965 and 1966) reported *Colletotrichum* and Alternaria over chilli fields.

and urediniospores over a groundnut crop. Dixit and Gupta (1981) studied the airspora over a barley field near Agra.

studied the airspora over banana plantations at Aurangabad. Wankhade (1983) studied the airspora of jowar and cattle shed at Aurangabad. Karna Bhagwan (1983) reported the airspora over sugarcane fields at Nanded. Saibaba (1983) studied airspora over cotton fields at Aurangabad. Pillai (1983) reported the airspora over arhar (tur) fields at Aurangabad. Patil (1985) studied the airspora components over Sorghum fields. Quazi (1985) studied the airspora components over groundnut fields and analysed the concentration of Cercospora and rust spores in relation to meteorological parameters and disease incidence. Venugopal Chari (1986) reported the airspora components over cotton, tur and banana fields at Nanded. An elaborate study to establish the relationship between aerobiology and epidemiology and forecasting of some jowar diseases was undertaken by Tilak and Jogdand (1989).

The present investigations on jowar fields at Dhule Agriculture College, are primarily intended to study aerobiological constituents, i.e. aeromicrobiota, and to correlate their incidence and progress in environment with meteorological parameters. It is also intended to establish the relationship between aerobiology and pathological aspects of jowar, an important food and fodder crop in Maharashtra.
Dhule or West Khandesh region lies between 20° 38' and 22° 03' north latitude and 73° 47' and 75° 11' east longitude. It covers an area of 13150 square kilometers. It is the western most of the districts on the northern border of Maharashtra State. It is bounded on the West by Dang, Surat and Baroch districts of Gujarat State and Jhabua and West Nimar districts of Madhya Pradesh on the north and on east and south by Jalgaon and Nasik districts. Dhule is one of the tribal districts of Maharashtra. The Western and Northern Talukas of Dhule district are dominated by Bhil, Pawara, Naikada, Kokani aborigin tribal populations inhabiting hilly mountain ranges of Sahyadri and Satpuda ranges. In fact three-fourths of the Dhule district is occupied by various Adivasi tribes. The Tapi river with its many tributaries flowing through the district in Western direction constitutes the chief drainage system divides the Dhule district in two unequal parts. The Narmada river strikes the north-west corner of the district. Within the district are included several ranges of Satpuda in the north and Sahyadris and their offshoots including several dykes in the west and south. The mean sea level height of the district is 600 meters. The highest peak in Dhule district - Toranmal in Satpuda ranges, rises up to 1155 meters.
Climate:

The climate of this region is on the whole dry except during south-west monsoon season. The year may be divided into four seasons. The cold season from December to February is followed by the host season from March to May. The south-west monsoon season which follows thereafter lasts till September. October-November constitute the post-monsoon season. From about the later half of February, the temperature increases steadily till May, which is the hottest part of the year. The maximum temperature can rise up to 46.6°C at Nandurbar. With the onset of south-west monsoon, by about the second week of June, there is an appreciable drop in day temperature and the weather is pleasant in monsoon season. The average rainfall for the district is 529 mm. The region gets rains mostly from south-west monsoon between June and October, and some local rains in May and scanty rains in November. The rainfall all over the district is not uniform. It varies from 525 mm to 1150 mm. Western part of the district - Navapur gets the maximum annual rainfall of about 1150 mm. Over much of the central part of the district - area around Sindkheda, Sakri and Dhule talukas - the rains are scanty, ranging up to 533.4 mm.

Agriculture in Dhule district: Nearly 82.51% of the total population of the district is engaged in agriculture. 50%
of the total land is under agriculture, 39.9% under forest, 
3.5% occupied by forest pasture and permanent grazing land 
and 5.7% of land is non-agricultural. Bajra, jowar, cotton 
and groundnut are the main kharif crops while jowar (rabi), 
wheat and gram are the main rabi crops. During 1985-86 
kharif season, percentages of various crops were as 
follows: Bajra 18.6%, jowar 12.8%, groundnut 11.4%, 
cotton 9.5%, rice 4.3%, kulith 3.9%. Out of the total 
area of cultivation, during 1985-86 for rabi crops, jowar 
occupied 11.0%, wheat 2.3%, gram 1.0%, Jowar and bajra 
provides fodder for cattle, staple food grains for human 
consumption. These two crops together occupied 42.4% of 
the total cultivated area during 1985-86. Sugarcane, cotton, 
chilli, onion etc. are important cash crops of the district. 
The following table provides information about agricultural 
situation in Maharashtra so far as jowar cultivation is 
concerned. Total land under cultivation, total land under 
irrigation and its percentage, total jowar production and 
<table>
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<th>1985-86</th>
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<tr>
<td>Total area under cultivation</td>
<td>202.61</td>
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<td>Total area under irrigation</td>
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<td>23.43</td>
<td>26.86</td>
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<tr>
<td>Percentage of irrigated land</td>
<td>12.2</td>
<td>11.9</td>
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<tr>
<td>Total area under jowar cultivation</td>
<td>6562</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(in thousand hectares)</td>
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<td></td>
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<tr>
<td>Total jowar production</td>
<td>39.22</td>
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<td>39.52</td>
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<tr>
<td>(in lakh tonnes)</td>
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<tr>
<td>Jowar yield per hectare</td>
<td>592</td>
<td>488</td>
<td>893</td>
</tr>
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<td>(in kilograms)</td>
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**Sorghum vulgare** Pers.

*Sorghum*, Great millet, jowar, cholam, *Sorghum* is one of the most important tropical grain crops. It is believed to have originated in the Nile valley and Central India. It has spread throughout the drier and warmer parts of India, China, other countries in South and East Asia, Africa and Southern Europe; and on increasing scale, as a stock-feed in the United States, South America, Australia. Thus it is cultivated throughout the warmer parts of the world and is best adapted to grow in the regions with lower rainfall. The grains form the staple food of several peoples in the tropics.
Before fifteen years, *Sorghum* was the fifth most important food and fodder crop all the world over preceded by wheat, rice, maize, and barley (Rachie, 1970). During the past decade, it has made a spectacular progress with respect to the area under cultivation, production and yield per hectare which have gone up to the third position among the food crops at world level. In India, with respect to area under cultivation and total production, jowar crop is third in number, i.e. after rice and wheat. It is an important food and fodder crop in India. It is grown in places receiving 500-1000 mm annual precipitation at 26°C to 32°C temperature range.

Like many other crops, jowar is also subjected to various types of plant diseases which cause extensive damage by reducing the grain production and quality as well. The poor quality of the fodder can also be attributed to the effect of these diseases which ultimately become un consumable.

Fungal pathogens play a significant role in causing the diseases and bringing in the losses in yields. The major fungal diseases which cause extensive damage to jowar crop in India are Smuts, Rusts, Downy mildews, Leaf spots, Rots, Ergot or Sugary disease, Bacterial diseases, Virus diseases, Phanerogamous parasites etc.
Covered smut, kernel smut, short smut or grain smut (*Sphacelotheca sorghi* (Link) Clint.), loose smut (*Sphacelotheca cruenta* (Kuhn) Potter), head smut (*Sphacelotheca reiliana* (Kuhn) Clint.), long smut (*Tolyposporium ehrenbergii* (Kuhn) Päe.) have been described. Other smuts are caused by *Sphacelotheca holici*. It causes a loose type of smut. Grain smut is caused by *Ustilago kenjiana* Ito.


Charcoal rot, stalk rot, blight or hollow stem caused by *Macrohomina phaseoli* (Maubl.) Ashby; Root-rot, crown rot, shoot rot, or milo disease caused by *Periconia circinata* (Mangin) Sacc., Stalk rot, top rot or seedling blight are caused by *Gibberella fujikuroi* (Saw) Wollenw, *Gibberella zeae* (Schw) Petch.
Ergot or sugary disease is caused by *Claviceps* sp., *Sphaelaea sorghi* Mc Rae.

Numerous fungi have been noted to be associated with the grains of *Sorghum*. Some of them are pathogenic while others are only saprophytes. There are many seed-borne pathogens apart from the common ones like smuts *Colletotrichum graminicolum*, *Helminthosporium turcicum*, *H. sorghicola*, *Aspergillus* sp., *Phoma* sp., *Fusarium* sp., *Chaetomella* sp., *Chaetomium* sp., *Cleosporium* sps., *Sordaria* sp. *Rhizopus* sp. have been recovered from surface sterilized *Sorghum* seeds. Bain (1950), Swarup (1955) and Swarup et al. (1956) studied fungal flora associated with seeds of grain *Sorghum* of six varieties for four years in Kansas state. They obtained 8702 isolates from surface sterilized seeds. Among these, 8047 belonged to Deuteromycetes, 607 to Ascomycetes, 27 to Basidiomycetes and 21 could not be identified. They were classified into 34 genera and 63 species. *Alternaria tenuis* predominated, *Chaetomium*, *Fusarium*, *Helminthosporium*, *Curvularia*, *Thielaviopsis* and *Aspergillus* were next in order of prevalence.

Black dot on grain is caused by *Phoma insidiosa* Tassi.

Bacterial blight or bacterial stripe is caused by *Pseudomonas andropogoni* (E.F.S.) Stapf.

Bacterial streak is caused by *Xanthomonas helicola* (Elliott) Starr & Burkh.
Except the very few aerobiological investigations, this crop was not so intensively studied. It was, therefore, essential to conduct the air-monitoring experiments for the first time in this part of Maharashtra, over this crop in order to trap the plant pathogenic fungal spores and to detect the source, dispersion and impact of meteorological parameters on such pathogens; and in turn the impact of pathogens on plant system. It is with this view that the present investigations were carried out.

The air-monitoring experiments were conducted over the crop fields for two years, which would definitely help in evolving a better forecasting system for various diseases over different crops.