DISCUSSION

The environment was pure, virgin, undisturbed and uncontaminated in past. The environmental pollution is an undesirable changes in the physical, chemical or biological characteristics of our air, land and water that harmfully affects human life and his desirable species, industrial processes, living conditions and cultural assets (Odium 1971). The definition given by the "Science Advisory Committee" of (U.S.A. 1965) is environmental pollution is the unfavourable alteration of our surroundings, wholly or largely as a by product of man's actions through direct or indirect effects changes in energy patterns, radiation levels, chemical and physical constitution and abundance of organisms.

TABLE 10.1  COMPOSITION OF ATMOSPHERIC AIR

<table>
<thead>
<tr>
<th>Component</th>
<th>% By Volume</th>
<th>% By Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (N₂)</td>
<td>78.09</td>
<td>75.54</td>
</tr>
<tr>
<td>Oxygen (O₂)</td>
<td>20.93</td>
<td>23.14</td>
</tr>
<tr>
<td>Argon (Ar)</td>
<td>0.93</td>
<td>1.27</td>
</tr>
<tr>
<td>Carbondioxide (CO₂)</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>0.02</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Human activities produce the significant amount of solid waste and varying concentration of gases resulting in a gaseous disbalance in the
atmosphere. Air pollution includes biopollutants like airborne mycoflora, phycoflora and pollen grains which severely affects the flora and fauna of the concerning areas.

Polluted atmosphere is the most dangerous and injurious condition for the organisms of industrial and urban areas including the metropolitan cities like Delhi, Mumbai, Kolkatta, Kanpur, Chennai, Hyderabad, Jaipur, Ahmedabad, Nagpur and Firozabad etc.

In order to assess the impact of air pollution on the concentrations of aeromycoflora of Jaunpur city and the statistical analysis of the observed data have also been made to evaluate their specific significance. Results obtained during the present research work has been explained in the corresponding chapters and their detailed discussion are as follows—

(A) QUALITATIVE ESTIMATION:

Difference in the composition of the local vegetation, ecological condition and variation of weather conditions and other seasonal factors account for the variation in the composition of pollen and fungal spores caught at the five different sites including control one.

Pollen grains:

The lower pollen incidence and type at SiteV could be due to sparse vegetation at this site and obstacles in the form of high building to check the free flow of air from other areas. The lower incidence in 1999-2000 may be due to the marked increase in total rainfall and relative humidity (Jain & Das 1981). Due to the prevalence of rains, the pollen grains are washed off from their sources. An increase in wind velocity during various months of 1999-2000 also affected the trapping of pollen. At high rate of wind velocity,
the chances of pollen get reduced (Sharma 1984). Poaceae pollen primarily bloom during and just after rainy season. Poaceae as a dominant taxa was present throughout the year with fluctuating amount. The report of Lakhanpal and Nair (1958) Kasliwal and Sanghvi (1969) Chanda (1973) and Datta and Jain (1992) are in support of my findings.

A large number of trees like Mangifera-indica, Artocarpus-hyterophyllous, Terminalia-arjuna, Azadirachata-indica, Acacia-nilotica, Dalbergia-sissoo, Ficus-religiosa etc. are growing in the Jaunpur city. The predominance of the specific pollen at specific site may be due to its presence near sampling site. Abundance of pollen was observed in March and September at different sites (Table-6.10).

Pollination period for trees are relatively short and adverse weather condition within the season significantly decreases the amount of pollen that become air borne (Roger 1993). The warm dry season stimulates flowering in some tree taxa and aids in dehiscence (Ljungkvist et.al. 1977, Soloman 1979). Atmospheric temperature is probably the most important environmental variable for pollen release (Singh et.al. 1988).

A positive and significant (P = < 0.001) correlation have been observed between the number of pollen grains at site I (VBS) and rest of other sites (Table 9 12)

**Fungal Spores:**

The types of fungal spores were more at Site 1, Site II, Site III and Site IV in 1998-99 as compared to Site V, which is due to less sources of spores. The total spores count was less in 1998-99 than 1999-2000. This can be again explained on the basis that there was low relative humidity as
compared to the year 1999-2000. Total count was more at Site I, Site II, Site III, Site IV as compared to Site V.

In 1998-99 and 1999-2000 maximum occurrence of spores were observed in the month of April. The rain received during July to October contributed for the build up of fungal air spora to occur in peak during March and July. A very low temperature during December and January seems to be responsible for the minimum occurrence of fungal spores. Inspite of the variations observed which may be due to minor changes in the microclimatic conditions, one thing is quite clear that the fungal spores register a peak in the month of March/April and second peak during August/September/October.

Cladosporium predominated at the all the sites followed by Alternaria, Aspergillus Penicillium, Curvularia and Uredospor es etc. These findings are in accordance with Rai and Singh (1998) and Bhat & Rajasab (1988) while Penzer et al. (1957), Rajan et al (1952), Mishra & Srivastava (1972) Gaur (1980) and Kumar (1984) found the predominance of Alternaria spores.

It is obvious from table 6.9 & 6.10 that the concentration of fungal spores and pollen grains were increased from Site V to Site I. It is because rural area’s ecology is much suitable for aero flora than urban one’s. Similar conclusion has also been drawn by Hamilton (1959), Lacey (1962), Davis (1969), Hyde (1969), Subba Reddi (1970), Long & Kramer (1972), Barkai-Golar and Glazer (1985), Awasthi & Agashe (1994).

Significant (P=0.001) and positive correlation were recorded between the fungal spore type and pollen type (Table 9.13). Urbanisation has an effect on the aerospora. The city of Jaunpur is now rapidly expanding and there is a mounting pressure for residential land
sites. As a result the vegetation of the suburban rural area's are being replaced by concrete structure's. Long term aeroflora monitoring will therefore indicate the changes in the local aerospora due to urbanization.

(B) QUANTITATIVE ESTIMATION:

In agriculture and horticulture, war is always being continued against disease caused by fungi which reduces the value of economic crops and occasionally destroy them completely. The increasing rate of biopollution in air in addition to other types of pollution has threatened our agricultural industries and in turn economy of the country. Drastic change in meteorological condition due further affect the pathogenic air spora. Even when unfavourable condition of some sort kill large number of biopollutants a few are likely to survive in unaffected sites from which they can spread out again when favourable conditions return, their power of rapid reproduction may result in the speedy reestablishment of a large population. Therefore air monitoring has become essential to understand the effect of biopollutants and the pathogenic incidences especially in crop plants. A systematic disease forecasting system certainly could prevent the substantial loss of agriculture products.

The investigation of airspora over rice fields in Japan have proved benifical in forecasting the out break of Blast disease of rice (Kuribayashi et.al. 1952 and Suzuki 1969). Berger (1969-70) made a successful attempt to forecast Celery blight in Florida using daily hydrothermograph and spore trap record. The work of Mehta (1952-54) in India made significant contribution to the problem of wheat rust. Tilak et.al. (1969 and on wards) have also prepared spore and pollen calenders, in the prevailing meteorological conditions for many crops in the state of Maharashtra. A close relation between number of spores
trapped and severity of disease has developed a reliable forecasting system by
Kiyasawa (1972).

Extensive studies of aerofungi have been done throughout the world
special emphasis on human allergens, phytopathogens and other biopollutants
by various methods including petriplate (Stackman and Christensen 1946;
Ainsworth 1952; Menna 1955; Turner 1966; Mishra 1972; Tilak and Kulkarni
exposure technique.

It is divulged by table 7.1 to 7.5 that Deuteromycetes (above 80%)
fungi were more frequent and appeared throughout the survey (Alternaria,
Curvularia, Drechslera and Penicillium etc.) While members of phycomycetes
and Ascomycetes were less frequent. It is possible because the monsoonic
climate of Jaunpur is unable to control the multiplication, viability and
consequently the frequent occurrence of aeromycoflora in the ambient air.

Dominance of the members of Deuteromycetes aeromycoflora
have also been reported by Rajan, Nigam and Shukla (1952); Hirst (1953);
Turner (1966); Dixit and Gupta (1980); Sahay (1983), Sinha (1986); Kumar
(1990); Singh (1991) and Prasad (1991). It is also noted that the total number
of fungal species isolated from Jaunpur is considerably very high (145) as
against 135 from Nawada (Kumar 1986), 72 from Gaya (Sahay 1983) and 77
from Bodhgaya (Sinha 1986) except 176 from Bihar sharif (Prasad 1991).

The aeromycoflora of Jaunpur was studied by petridish exposure
technique from November 1998 to October 2000. Altogether 57 genera and
145 species were isolated. Out of which maximum 42 genera have been
recorded in the month of March (1999). The month of October (1999) and
September (2000) showed minimum number of 9 genera. Out of 145 species, maximum 74 species were recorded in the month of March (2000). Similar result have been observed by Prasad (1991) but Mishra (1974) reported maximum in September and Singh (1991) in October. Minimum 27 species were observed in September (1999).

There was a positive and significant (P = < 0.001) correlation were observed between number of taxa/month at Site I and other Sites (Table 9.14). Similar type of correlation were observed between number of species/season at site I and number of species/season at different sites (Table 9.15).

Out of 28127 colonies, maximum 76 colonies/petridish have been observed in the month of March (2000). Mishra (1971) and Satpute et.al. (1986) recorded maximum in September, Singh (1991) in April but Prasad (1991) found in March. Minimum 15 colonies/petridish were found in the month of August (1999) while Karuna et.al. (1988) and Prasad (1991) reported minimum number in September.

A positive and significant (P = < 0.001) correlation between number of colonies per month at Site I and number of colonies/month at different sites has been recorded (Table 9.16).

It is quite clear from table 7.1 to 7.5 that Cladosporium-cladosporioides may be considered as the first dominant fungi of this area followed by Alternaria and Aspergillus (Rai and Singh 1988; Bhat and Rajasab 1983; Prasad 1991) while Kumar (1990) and Sinha (1986) found that Aspergillus niger was the dominant fungi at Nawada and Bodhgaya respectively. But their second dominant aero fungi was Cladosporium. This clearly suggest that the hot belt representing more or less similar climatic condition which harbour
more thermophilic fungi like *Cladosporium* and *Aspergillus*. The report of Ramalingam (1966-67); Mishra et al. (1971); Satpute et al. (1987); Singh (1991) and Prasad (1991) are in support of my findings.

The genera *Cladosporium* is represented by 8 species Viz, *Cladosporium cladosporioides*; *Cladosporium epiphyllum*; *Cladosporium sphaerospermum*; *Cladosporium oxysporum*; *Cladosporium tenuissimum*; *Cladosporium musae*; *Cladosporium herbarum* and *Cladosporium uredinicola*. The highest concentration of *Cladosporium* was observed in the month of June (2000) when average temperature, relative humidity and rainfall were 29.3°C, 69% and 188.3mm respectively. A positive and significant (P = <0.001) correlation were observed for the *Cladosporium* spores with its number in morning, noon and evening (Table 9.11).

The *Alternaria* was second dominant aeromycoflora after *Cladosporium* and represented by number of species such as. *Alternaria dianthicola*; *Alternaria triticina*; *Alternaria padwickii*; *Alternaria alternata*; *Alternaria brassicicola*; *Alternaria brassicae*; *Alternaria citri*; *Alternaria humicola*; *Alternaria tenuis*; *Alternaria pluriseptata* and *Alternaria tenusssima* etc. *Alternaria* having a single peak in May (1999) but Singh (1991) found double peaks, lower in October and higher in the month of April. It exhibited positive and significant (P = <0.001) correlation between its number in morning, noon and evening (Table 9.11).

*Aspergillus* (viz *Aspergillus clavata*; *Aspergillus repens*; *Aspergillus glaucus*; *Aspergillus condidus*; *Aspergillus carneus*; *Aspergillus chavelei*; *Aspergillus flavus*; *Aspergillus fumigatus*; *Aspergillus jopanicus*; *Aspergillus nidulans*; *Aspergillus niger*; *Aspergillus niveus*; *Aspergillus sydowi*;
Aspergillus luchuensis; Aspergillus sulphureus; Aspergillus tamari; Aspergillus terreus; Aspergillus ustus and Aspergillus versicolor etc.) was occurred throughout the observation having double peaks higher in June (1999) and lower in the month of September (2000).

Curvularia has been recorded together with number of species i.e. Curvularia lunata; Curvularia indica; Curvularia pollenscens; Curvularia tuberculata; Curvularia clavata; Curvularia oryzae, Curvularia senegalensis; Curvularia leonensis and Curvularia ovoides has shown two peaks minimum in the month of July (1999) and maximum in the month of August (2000). Its highest concentration was reported at the evening.

Fusarium was represented by 7 species such as Fusarium equiseti; Fusarium oxysporum; Fusarium poe; Fusarium moniliforme; Fusarium sporotrichoides, Fusarium nivale and Fusarium vasinfectum. Fusarium has shown multiple peak in different months and its maximum concentration was found in the mid-day i.e. noon. Similar observation have been also recorded by Gregory and Sreeramula (1958); Mishra (1971); Kumar (1990) and Prasad (1991).

Penicillium rotting mould present throughout the isolation with single and double peaks in different type of species. Altogether 10 species has been identified viz Penicillium citrinum; Penicillium funiculosum; Penicillium chrysogenum; Penicillium cyclopium; Penicillium janthinellum; Penicillium puoerulum; Penicillium wartmanni; Penicillium nigricans; Penicillium favanicum and Penicillium herqui. Penicillium chrysogenum; Penicillium wartmanni and Penicillium nigricans showed its presence only in rainy season while Penicillium favanicum and Penicillium herqui only appeared in summer. Singh (1991) found two peaks in the month of February and August.
**DISCUSSION**

*Drechslera*, a pronounced pathogen of cereals was present throughout the year having multi-peak in the month of November (1998) March (1999) and May (1999) during 1998-99 and in the month of August, November and June during 1999-2000, comprising 9 species *Drechslera tetramera; Drechslera dematoidea; Drechslera oryzae; Drechslera helianthi; Drechslera ellisi; Drechslera sorcicola; Drechslera poe; Drechslera australiensis* and *Drechslera hawaiiensis*. *Drechslera ellisi; Drechslera australiensis* and *Drechslera hawaiiensis* were present throughout the year. Rest of the species showed scanty presence throughout the year.

*Mucor* was represented by five species i.e. *Mucor varians; Mucor globosus; Mucor pussillus; Mucor heimalis* and *Mucor fragilis* during the investigation. *Mucor globosus* and *Mucor pussillus* appeared throughout the year while *Mucor varians* and *Mucor heimalis* only in summer.

Instead of above genera and species a number of other fungal species (*Chapter VIII*) have also been isolated from the air once or twice with irregular manner during the observations.

**Seasonality:**

When the data of two years was compared together from table 7.6 and 7.7 it was observed that maximum number of 74 species were recorded during summer season especially in the month of March while minimum 27 species were observed in September (Rainy season). Overall seasonality shows that lowest number of aeromycoflora during rainy season while maximum during summer. Similar finding was also reported by Meena (1955) but Kumar (1986) observed highest during winter and lowest in summer.
Diurnal hours and fungal species:

The fungal composition did not affect by hours of collection. Most of the species which could be isolated in day hours were also recorded during night hours but more number of spore could be isolated in day hours of collection in the air, it is because most of the spore discharged from sporangium or sporangiophore during day hours due to presence of eddy air in day. Only seldom appearing species showed their variation for time of collection.

Determination of spore concentration of allergenic, biopollutant and pathogens in each season is also important because even a single spore may be able to start infection under favourable condition. Even under unfavourable condition a heavy spore concentration may cause epidemics (Roten and Cohen 1971 and 1974).

(C) STATISTICAL ANALYSIS

Analysis of variance:

Analysis of variance (ANOVA) or F-test have been worked out to test the validity of the data and the significance of the variations in the data among the Sites and months during the present course of study. Analysis of variance exhibits significant (P = < 0.001) variations for the qualitative and quantitative estimation of aeromycoflora among the Sites and months. However, the variations between the sites are of more significant than the variations between the month. The detailed study of ANOVA have been done in Chapter IX.
**Correlation Coefficient:**

It is the measure of relationship among the different analytic parameters and among the same parameters for the different Sites. Correlation coefficient has been calculated to evaluate the air pollution impact on the aeromycoflora of Jaunpur city.