SUMMARY

Aerobiology, one of the important scientific pursuits has very wide applications in various fields such as pathology, palynology, meteorology, allergology, air pollution effects etc. and thus evolved as a major integrated research field. Aerobiology mainly deals with study of airborne biological components, their transport, atmospheric interaction, deposition process etc. Pollen grains and fungal spores constitute major components of the atmosphere. The studies of airborne pollen, fungal spores, their variation with environment and location is very essential, as they have been implicated in various human allergic disorders and plant and animal diseases. Bangalore city with its salubrious climate nurtures varieties of plant species which release abundant pollen and spores to the atmosphere. Their high prevalence accounts for the high incidence of allergic disorders among sensitive persons. Therefore, a detailed aerobiological investigation was carried out at Bangalore south for a period of two years. The monitoring of the airspora of Bangalore south was carried out with vertical cylinder pollen trap installed at a height of 6 m at Lalbagh Botanical Gardens (LB), 12 m at National College (NC) and 36.6 m at Jayanagar Shopping Complex (JC).
The sampling period for LB was from April 1982 to March 1984 and for NC and JC it was from August 1982 to July 1984. Of these centres, LB represents a rich garden complex and JC and NC, a combination of residential and commercial complex. In addition to vertical cylinder trap sampling, airborne fungal spores at JC were also sampled by nutrient culture plate technique.

In the present research project, aerobiological aspects investigated included (i) Field botanical studies involving compilation of pollination calendar, pollen productivity estimation in some plant species, studies on pollen flora - pollen morphological characterisation; (ii) Daily monitoring of the airborne pollen, fungal spores and other bioparticles of interest such as trichomes, hyphae, insect and algal components at all the centres; (iii) Evaluation of airborne pollen and fungal allergenicity by conducting clinical tests with their antigenic extracts.

The results of the above research aspects carried out are summarised as follows:

1. Field botanical survey conducted for three years revealed that the vegetational structure is mostly of cultivated ornamental varieties. Members of Caesalpiniaceae, Mimosaceae, Fabaceae, Arecaceae, Bignoniaceae, Euphorbiaceae...
are the dominant families. *Cassia siamea*, *Peltophorum pterocarpum*, *Eucalyptus*, *Jacaranda mimosifolia*, *Spathodea campanulata*, *Cocos nucifera*, *Tabebuia* sp., *Parthenium hysterophorus*, *Ricinus communis*, members of *Poaceae*, *Amaranthaceae*, *Cyperaceae* form the most common species in this region. Lalbagh gardens, one of the centres is characterised by the presence of assorted flora of herbs, shrubs and trees of medicinal and economic plant species in addition to common plant species.

Pollination calendar for 571 plant species of Bangalore south comprising 254 trees, 109 shrubs, 188 herbs and 14 grass species is presented which includes their pollinating nature, prevalence in the study region. Type, number and degree of prevalence of anemophilous group seem to be less compared to entomophilous groups. Two major pollinating seasons recognised were January - May with respect to flowering of trees and June - December for flowering of weeds and grasses. The flowering pattern over 3 years slightly varied as flowering periodicity is subjected to fluctuating environmental conditions.

Among the 21 plant species investigated for pollen productivity, *Cassia siamea* formed the highest pollen producer per anther followed by *Delonix regia*, while *Azadira-chta indica* formed the least pollen producer. *Casuarina*
squisetifolia in spite of its very low production formed the predominant airborne type, whereas Delonix regia, Millingtonia in spite of their large pollen production formed the least significant airborne types.

Pollen flora studies comprised pollen morphological investigations of 141 genera which included common as well as rare species. Characters such as shape, size, aperture and ornamental pattern have been described and the study aided in the specific identification of airborne pollen types.

2. (a) The atmosphere of Bangalore south is rich in pollen grains and fungal spores both in terms of quality and quantity. Fungal spores predominated over airborne pollen. The ratio being 1:1.2 - 1.5 at LB, 1:2.7 - 2.8 at NC and 1:2.8 - 2.9 at JC.

A total of 160 airborne pollen types spread over 165 families were identified for Bangalore south. The group dicotyledonae formed the dominant part of the airborne pollen flora which ranged from 75% - 85% while pollen of gymnospermae accounted for less than 1.5%.

Pollen calendar for three centres for 2 years have been compiled with emphasis on major airborne types. The dominant airborne types encountered were Parthenium
hysterophorus, Casuarina equisetifolia, Poaceae, Eucalyptus, Cassia, Peltophorum pterocarpum, Pongamia, Typha angustata, Amaranthus, Ricinus communis, Cyperaceae. However, the order of dominance during 2 year study slightly varied for 3 centres. These together constituted 58.61% (LB), 75-76% (NC) and 78-84% (JC). The composition of Casuarina was 13 - 16% (LB), 9 - 21% (NC), 17 - 25% (JC), Parthenium 9-13% (LB), 26-28% (NC), 34-39% (JC). The contribution of Parthenium pollen in the atmosphere during its peak season (July - August) was found to be significantly higher which ranged from 50 - 75% of the monthly total pollen.

Variation in the total airborne pollen and principal types are set out in tables and figures. Each pollen type exhibited distinct seasonal periodicity and the peak incidence of most of the pollen types was in accordance with the peak flowering period. Yearly and day to day observation recorded were attributed to fluctuating climatic conditions.

The prevalence of most of the common ornamental flora was less than 0.2% in the atmosphere. Although garden exhibits a rich flora, only 8% of ground flora is reflected in the total airborne pollen flora. However Duabanga, Berria, Clusia, Mammea, Macadaemia, Garuga, Dillenia, Gardenia were found to be specific to Lalbagh area with respect to prevalence of plant species as well as airborne types.
Comparatively maximum appearance of pollen types as well as counts were recorded during December - March.

Among airborne pollen groups tree pollen formed the dominant group at LB, weed pollen at JC. The incidence of tree pollen was 56-61% (LB), 45-46% (NC), 35-43% (JC), weed pollen accounted for 23-28% (LB), 44-46% (NC), 50-54% (JC).

Anemophilous pollen group predominated over entomophilous and amphiphilous groups. The contributions of anemophilous group were 45-46% (LB), 47-49% (NC and JC). Amphiphilous incidence was 32-35%, 40-41% and 42-44%, whereas the incidence of entomophilous group was only 18-21%, 9-10% and 7% at LB, NC and JC respectively.

Three major pollen seasons were demarcated - December - March (tree pollen), April - May (weed and tree pollen), June - September (weed pollen). Grass pollen prevalence was highest during October to December.

(b) A total of 79 fungal types were identified from the atmosphere of Bangalore south. Deuteromycotina group accounted for major fraction with 77-81% followed by basidiomycotina with 17-27% and ascomycotina with only 2.5 - 4%.
The ratio of spore counts for LB: NC: JC was 1: 3.3-3.6 : 6.4.

The fungal calendar prepared for LB, NC and JC for the period 1982-84 revealed the predominance of airborne fungal types namely, *Cladosporium*, *Alternaria*, *Curvularia*, basidiospores, ascospores, uredospores, *Helminthosporium*, *Cercospora*, *Nigrospora*, *Pithomyces*. They accounted for 91.96% - 92.7% (LB), 92.77% - 94.73% (NC) and 94% (JC). *Cladosporium* exhibited higher maxima during July - April; *Alternaria* and *Helminthosporium* during July - August and January - February; basidiospores during October - November; ascospores during August - September.

In general the maximum incidence of airspora was during hot wet season (July - September) minimum during hot dry period (April - March).

The monthly seasonal and yearly variation observed in 3 centres is due to the resultant of the fluctuations in the environmental factors.

3. Pollen counts showed significant positive correlation with temperature during cool dry season and negative correlation with wind speed, relative humidity and rainfall during hot wet season.
Fungal spore counts have showed significant positive correlation with all the variables during hot wet season and showed negative correlation with temperature and wind speed and positive correlation with relative humidity during cool dry season.

4. Total of 49 fungal types were recognised from culture plate exposure studies. The predominant types recorded were Cladosporium, Aspergillus, Penicillium, Curvularia, Alternaria and Fusarium and these were isolated all through the year.

Maximum number of isolation were obtained during cool dry season (December - March) and minimum during hot dry season (April - May).

Comparative inference that could be drawn from airspora study by vertical cylinder and culture plate sampling methods was (i) the trapping of more fungal types by the visual count method (vertical cylinder), (ii) high degree of prevalence of Aspergillus-Penicillium in culture plate method, (iii) comparatively higher representation of Botryodiploidla, Pithomyces, Helminthosporium and few others in visual count sampling method, (iv) significant variation with respect to the total incidence of spore types and their seasonal prevalence.
5. Miscellaneous bioparticles formed less than 3% of the total aerobiota at all the centres. Hyphal fragments and trichomes formed the dominant types in this group.

6. The analysis of the airspora at different heights indicated minimum airborne pollen types (198) at a height of 36.6 m (JC) when compared to 6 m (232 types) at LB. Whereas the concentration of airspora was found to be maximum at JC compared to NC and LB, the ratio being 4:3:1. However, entomophilous and miscellaneous pollen types were more at 6 m height (LB).

The predominant pollen type at LB was tree pollen - *Casuarina*, whereas at NC and JC the predominant type was weed pollen - *Parthenium*.

Variations observed at different heights could be attributed to location of trap site, vegetational structure and also environmental factors.

7. The survey of the prevalence of allergic disorders among 330 cases of respiratory allergy at Bangalore revealed rhinitis-asthma in 67% of the cases. Rainy season accounted for high incidence of allergy disorders (10.30%). 55.15% were found to be sensitive to pollen antigens and 41.82% to fungal antigens.
city, *Parthenium hysterophorus*, *Albizia lebbeck*, *Amaranthus spinosus*, *Cassia siamea*, *Ricinus communis*, *Xanthium strumarium* evoked significant positive reaction in sensitive individuals.

Among 21 fungal types skin tested, *Mucor mucudo*, *Candida albicans*, *Alternaria tenuis*, *Trichoderma* formed the major allergens.

The prevalence of all these airborne pollen and fungal types except *Mucor* have been recorded in the aerobiological studies carried out at Bangalore south.