Observations
V - OBSERVATIONS

a) Floristic Survey of the study areas and other parts of the city

Botanical survey revealed a rich flora in and around the Bangalore city which has evolved due to its ideal geographical set up and congenial climate. The characteristic topography of the district with the underlying gneissic granite rock formation having a thin mantle of sandy loam or sandy clay soil accounts for the high degree of xeromorphy in the vegetation. The natural vegetation is largely of dry deciduous and scrub type. However, Bangalore has acquired the name the "Garden city of India", due to beautiful parks, gardens and tree lined avenues within city limits. The two well known parks of botanical interest are Lalbagh botanical garden covering 250 acres of land with 4500 species representing 150 plant families and Cubbon park with 300 acres of land situated in Southern and Central part of Bangalore respectively.

Ramaswamy and Razi (1973) gave a detailed account of vegetation of Bangalore in their publication "Flora of Bangalore District". They have recorded 979 species and 542 genera distributed in 133 families.
The plants in the study areas constitute mainly of cultivated varieties. The avenues are lined with *Cassia siamea*, *Jacaranda mimosifolia*, *Delonix regia*, *Samanea saman*, *Peltophorum pterocarpum*, *Millingtonia hortensis*, *Tabebuia rosea*, *T. argentia*, *Spathodea complanata*, *Polyalthia*, *Pongamia*, *Dolichandron atrovirens*, *Bauhinia purpurea*, *Lagerstroemia flos-reginae*, *Firmiana colorata*, *Calwella recemosa*, etc.

*Cocos nucifera* and *Eucalyptus globulus* also flourish abundantly in these localities.

The ornamental shrubs of very common occurrence at parks and domestic gardens are *Ixora coccinea*, species of *Hibiscus*, *Acalypha*, *Croton*, *Bougainvillea*, *Nerium*, *Mussaenda frondosa*, *Rosa*, *Ipomea*, *Tecoma stans*.

The preponderant weed of Bangalore is *Parthenium hysterophorus*. This perilous weed, a native of tropical South and North America has prospered in alarming proportions in uncultivated areas, vacant sites and road sides. However, over the years, with the introduction of Parthenium eradication programmes such as the mexican beetle (*Zygogramma bicolorata*), Ceasalpinaceae member *Cassia sereeae*, application of salt solution, urbanisation, the rampant growth of this weed has been controlled to some extent. Other herbaceous weeds of common occurrence are
Amaranthus species, Borreria stricta, Argemone mexicana, Tridax procumbens, Mimosa, Stachytarpheta indica, Artemisia, Dodonaea, Euphorbia hirta, Typha, Xanthium, etc.

The important wild grasses and sedges of the areas are Cynodon dactylon, Heteropogon, Poa, Cyperus, Chloris barbata, Typha angustata, Eragrostis sp., Imperata cylindrica.

Common herbaceous ornamental plants are species of Coleus, Salvia, Canna, Impatiens, Asparagus, Chrysanthemum, Petunia, etc.

b) Incidence and Morphological descriptions of significant airborne pollen grains and Fungal spores.

1) Airborne Pollen grains

During the present survey conducted over two years at 6 different non-industrial indoor environments by Boehm's personal sampler, totally 49 types of pollen grains belonging to 32 families have been identified. A classified list of these pollen along with their morphological description is given below:

Angiosperms

Acanthaceae

Pollen grains suboblate to prolate, size ranging between 25 - 45 x 22 - 32 μ, amb circular semi-angular,
tricolporate, exine thick, sexine reticulate, granulate or areolate.

Amaranthaceae.

Amaranth - Chenopod

Pollen grains belonging to this group are spheroidal, 14-36μ in diameter; pantoporate, pores numerous, globally distributed, the limniod area separated by muroid ridges; sexine often tegillate undulating with a granular or reticuloid surface.

Celosia argentina L.

Pollen grains spheroidal, 22-30 μ in diameter, pantoporate, with 22-25 pores, circular, 4-4.5 μ diameter, verrucose membrane, exine 3 μ thick, tectate, sexine 2.5μ thick, punctitegillate with suprategetal processes.

Gomphrena Mart.

Pollen grains spheroidal, 10 -29 μ in dia., fenestrate (pantoporate), pores situated in luminoid depression which are pentagonal or hexagonal, exine 4 μ thick, sexine reticulate, muri simplibaculate or clavate.

Asteraceae

Pollen grains oblate spheroidal to prolate spheroidal, 15 -48 x 16 - 40 μ; amb triangular, 3 colporate; exine 1-3 μ
thick, sexine tectate with scabrate, verrucate or echinate processes.

Parthenium hysterophorus L.

Pollen grains oblate spheroidal (16 x 17 \( \mu \)); 3 colporate; exine with spinules included is 4.4 \( \mu \) thick, sexine about 3 \( \mu \) thick with pointed spinules. Spinules 2\( \mu \) high with pointed apices.

Xanthium strumarium L.

Pollen grains prolate spheroidal, 25 - 28 \( \mu \), 3 colporate; exine 2.5 \( \mu \) thick, spinulose.

Artemisia vulgaris L.

Pollen grains oblate - spheroidal, 19-23 x 20-25 \( \mu \), 3 colporate fossaaperturate, colpi 12 x 2 \( \mu \) long, oralalongate, exine 3 \( \mu \) thick, gradually thinner towards aperture, tectate, sexine 2 \( \mu \) thick, spinulose.

Areceae

Cocos nucifera L.

Pollen grains large, plano - convex in shape, 40 - 50 \( \mu \) in the long axis and 30 - 40 \( \mu \) in the short axis, monosulcate, sexine smooth to granulose.
Bignoniaceae

Millingtonia hortensis L.F.

Pollen grains subprolate, 46 - 54 x 40 - 42 μ; amb circular; 3 colporate; exine 2 μ thick, sexine 1 μ thick, reticulate, homobronchate, muri straight, simpli - baculate; lumina polygonal.

Caesalpiniaceae

Cassia L.

Pollen grains oblate spheroidal to prolate, 24 - 47 x 27 - 46 μ, amb circular or semiangular; 3 colporate, exine 1 - 2 μ thick, sexine reticulate to foveolate.

Cassia siamea Lamk.

Pollen grains suboblate to prolate spheroidal; 36-43 x 35 - 46 μ, amb circular; 3 colporate; exine 1.2 - 1.5 μ thick, sexine reticulate.

Peltophorum pterocarpum (DC) Bak, ex Heyne.

Pollen grains oblate spheroidal, 43 x 52 μ; amb circular; 3 colporate, exine 4 - 6 μ thick, sexine reticulate, lumina polygonal and broad.

Capparidaceae

Pollen grains prolate, 26 - 34 x 18 - 26 μ, 3
colporate, ora lalongate, exine 2.5 μ thick, sexine 1.5 μ thick, punctitegillate.

Casuarinaceae

**Casuarina equisetifolia** J.R. & G.

Pollen grains suboblate, 19 - 21 x 22 - 30 μ, amb triangular with convex sides, 3 porate, aspidate, sexine tectate with surface transgressed by narrow, irregular ridges with minute superimposed spines.

Combretaceae

**Terminalia** L.

Pollen grains prolate, 19 - 25 μ long and 16 - 24 μ wide; amb rounded hexagonal; 3 colporate alternating with 3 pseudocolpoid thin walled areas which are contiguous at the poles. Exine 2 μ thick, sexine psilate.

Convolvulaceae

Pollen grains 3(-4)-colpate, pantoporate, prolate to oblate, 22 - 70 x 20 - 64 μ, amb circular to interangular, exine 1 - 7 μ thick, tectum psilate with echinate, clavate, baculate, gemmate or long processes, sexine granulate, frequently striato - granulate.

Commelinaceae

Pollen grains oblate, monosulcate, 13 - 42 x 19 - 60 x 13 - 26 μ; exine 1 - 2 μ thick; sexine psilate, scabrate
with baculate, clavate or echinate processes.

**Cyperaceae**

Pollen grains pyriform to ovoid, 24 - 40 μ long to 21 - 30 μ across; amb oval to circular; apex frequently acute and the base planar; 1 - 4 poroid, periporate with 3 lateral and basal pores; lateral pores linear or indistinguishable, exine 1 μ thick, sexine granulate or psilate.

**Eleocarpaceae**

*Muntingia calabura* L.

Pollen grains prolate spheroidal, 13.5 x 12 μ, amb circular; 3 colporate; exine 1 μ thick, sexine finely reticulate.

**Euphorbiaceae**

*Acalypha* L.

Pollen grains oblate spheroidal, 10 - 16 x 10 - 16 μ; amb triangular, circular or sometimes tetragonal; 3 - 4 colporate; colpi short 5 - 7 x 3 - 5 μ; the pores ovoid with thickened margins. Exine reticulate.

**Phyllanthus** L.

Pollen grains oblate spheroidal to sub prolate; 17 - 22 x 12 - 17 μ; amb circular; 3 - 5 colporate; exine 1 μ thick, sexine granulate.
**Phyllanthus emblica** L.

Pollen grains oblate spheroidal, 20 x 22 μ; amb circular, 5 - 6 colporate, pores very clear, exine 1 μ thick, sexine finely reticulate.

**Ricinus communis** L.

Pollen grains oblate spheroidal, 26 - 34 μ, amb triangular, 3 colporate, exine 1 - 5 μ, sexine finely reticulate.

**Emblca officinalis** Gaertn.

Pollen grains oblate - spheroidal, 22 x 24 μ, amb circular, 4 - 6 colporate, colpi short, ora circular, 1 μ thick, finely reticulate.

**Mallotus philippenis** (Lamk) Muell.

Pollen grains spheroidal, 27 - 28 μ, 3 colporate, ora lalongate, exine 2 μ thick, sexine 1 μ thick, psilate.

**Labiatae**

**Leucas aspera** (Willd.) Spreng.

Grains 3 - colpate, suboblate to spheroidal, 20 - 28 x 17 - 29 μ, amb circular, 21 - 25 μ wide, exine 1.5 μ thick, tectum psilate or with scabrate processes, sexine finely reticulate, nexine as thick as sexine.
Lythraceae

*Lagerstroemia flos-reginae* Retz.

Pollen grains prolate, 33 - 37 x 30 - 34 μ, amb rounded triangular, 3 colporate, ora circular, conspicuous, exine 1.5 - 2 μ thick, sexine 1 μ thick, baculate.

*Lawsonia alba* Lamk.

Pollen grains prolate - spheroidal, 14 x 13 μ, 3 colporate, ora circular, aperture membrane protrudes behind the general surface of the grain, exine 2 μ thick, tectate, sexine 1.5 μ thick, distinctly foveolate.

Mimosaceae

*Acacia arabica* Mill.

Pollen grains polyads, 16 celled, more or less flattened, spheroidal or oblate, 36 - 50 μ in diameter, individual cells subglobose in periphery and square at the centre, 12 - 9 μ in diameter, 3 colporate, exine 1 - 5 μ thick, tectate, granulate.

*Albizzia lebbeck* (L) Willd.

Pollen grains polyads, 16 celled, spheroidal, 87-100 μ in diameter, individual cells are mostly tetragonal, psilate, exine 1.5 - 2 μ thick, tectate.
Moraceae

Artocarpus heterophyllus Lamk.

Pollen grains oblate - spheroidal, 12 - 15 x 12 - 15 µ
amb circular, 3 porate, pore circular, exine 1 µ thick, tectate, tectum psilate.

Broussonetia papyrifera Vent.

Pollen grains oblate - spheroidal, 14 - 17 x 16 - 17 µ
amb circular, 2 - 3 porate, pores more or less circular, 1 - 1.5 µ in diameter, aspidate, exine 0.5 - 1 µ thick, tectate, scabrate.

Morus alba L.

Pollen grains oblate - spheroidal, 18 - 22 x 20 - 24 µ
amb circular, 2 - 3 porate, aspidate, onci present, ora circular, exine 1 - 1.5 µ thick sexine granulate.

Myrtaceae

Eucalyptus globulus Labill.

Pollen grains oblate - spheroidal, subisopolar, 18 - 22 x 24 - 30 µ, amb triangular, 3 syncolpate, anguloaperturate, exine 1.5 µ thick, sexine 1 µ thick, slightly thickened at colpi margins, granular.

Pollen grains peroblate - oblate, 14 - 18 x 19 - 24 µ
amb triangular, 3 colporate, parasyngcolporate, ora circular, 11 x 13 μ, exine 1 μ thick, psilate or granulate.

**Poaceae**

Pollen grains spheroidal to ovoid, 22 - 122 μ in diameter, 1 porate, occasionally the pore is surrounded by an annulus and covered by an operculum, exine 1 - 1.5 μ thick, sexine face may be granular to finely reticulate.

**Rubiaceae**

*Borreria stricta* (L.P.) K.Sch.

Pollen grains suboblate - oblate, 25 x 30 μ, amb circular, 5 - 6 colporate, exine 1.5 - 2 μ, thick. tectate, scabrate, sexine 1μ thick, finely reticulate.

*Borreria hispida* (L.) Schum.

Pollen grains suboblate, 58 - 63 x 63 - 79 μ, amb circular, stephanocolpate (10 - 14 brevicolpate), exine 2.5 - 3 μ thick, tectate, sexine 2 μ thick, conspicuously granulate.

**Sapindaceae**

*Dodonaea viscosa* L.

Pollen grains prolate - spheroidal, 28 - 30 x 24 -27 μ,
amb subcircular or subtriangular, 3 colporate, ora lalongate, 2 x 8 $\mu$ in diameter, faintly aspidate, exine 2 $\mu$ thick, tectate, sexine granulate.

**Solanaceae**

*Solanum nigrum* L.

Pollen grains spheroidal, 24 - 30 $\mu$ in diameter, amb subcircular, 3 colporate, ora lalongate, pores slightly protruding, exine 1.5 $\mu$ thick, tectate, sexine striatoreticulate.

**Typhaceae**

*Typha angustata* Bory and Chaub.

Pollen grains ovoidal, 25 - 30 $\mu$ in length, amb circular, 1 porate, exine 1 - 1.5 $\mu$ thick, sexine reticulate with polygonal lumina.

**Ulmaceae**

*Holoptelea integrifolia* (Roxb) Planch.

Pollen grains spheroidal to suboblate, 27 x 33 $\mu$, amb circular, 4 - 6 porate, circular pore 2.1 - 3.5 $\mu$ in diameter, exine 1.5 $\mu$ thick, sexine with irregular ridges separated by small lacuna.

**Anacardiaceae**

Grains 3 - colpate; prolate to subspheroidal; 18 - 49 x 18 - 41 $\mu$, amb circular or angular, ora transversely elliptic
PLATE II - Figs. r-z

Photomicrographs of some of the airborne pollen grains trapped during the aerobiological survey.

r. *Amaranthus* sp. x 400
s. *Cassia siamea* x 1000
t. *Casuarina equisetifolia* x 1000
u. *Dodonaea* sp. x 1000
v. *Eucalyptus* sp. x 400
w. *Parthenium* sp. x 400
x. *Peltophorum* sp. x 400
y. *Poaceae* x 400
z. *Typha* x 400
or transversely parallel, exine 1 -1.5 μ thick; tectum with scabrate processes, sexine reticulate, striato-reticulate or granulate. Nexine thinner than sexine.

**Lamiaceae**

Pollen grains oblate to prolate, 17 - 75 x 13 - 80 μ, amb circular, elliptic, rarely semi angular, 3 or 6 colpate, exine 1 - 3.5 μ, sexine usually reticulate.

**Oleaceae**

Pollen grains prolate to suboblate, 19 - 32 x 13 -28 μ, amb triangular, circular, 3 colporate, exine 1 - 4 μ thick, sexine reticulate, reticulation fine with small polygonal lumina and narrow muri.

2) **Airborne fungal spores**

As many as 54 types of fungal spores were identified in the present investigation and the types observed are listed in Table-2 along with the sites from where they were isolated. The list is followed by a brief morphological description of some of these spores. Some of the predominant spores have been illustrated in the form of photomicrographs.
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<th>AC Office 2</th>
<th>Non-AC Office</th>
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<th>Patient's House -2</th>
<th>Control House</th>
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**Myxomycota**

**Myxomycetes**

Spores colourless to pale coloured to brownish grey, single celled, globoid, wall thin which may be echinulate or with subhemispherical warts, tuberculate processes or reticulate ornamentation. Spores measure 10 - 15 μ.

**Eumycota**

**Zygomycotina**

Spores colourless to pale coloured, spherical or ellipsoid with thin smooth membrane. Spores are contained in sporangia or attached to heads.

**Ascomycotina**

**Dothideales**

**Didymosphaeria** Fuckel.

Ascospores are brown, elliptic, one septate, slightly constricted at the septum. Spore size varies from 9.4 - 17 x 6.7 - 8.2 μ.

**Leptosphaeria** Ces. de Not.

Ascospores 2 to many septate, fusiform, yellow to yellowish brown, may or may not be constricted at septum. Spore size varies from 12.2 - 23.5 x 4.2 - 7.7 μ.

**Pleospora** Robenh ex Ces & de Not.
Ascospores yellow to brown, oblong, muriform with transverse and longitudinal septa and few oblique septa, wall smooth. Spore size varies from 20.2-38 x 13 - 15 μ.

**Pringsheimia**

Spores hyaline, cylindric, broadly rounded at both ends. Spores with three horizontal septa and also having vertical septa. Spore size ranges from 8.5 - 15.5 x 3.5 - 5 μ.

**Sporormia** de Not.

Spores dark brown, opaque, cylindric, straight, broadly rounded at both ends, spores three septate, deeply constricted at the septa and easily separating. Spore size varies from 30 - 35 x 4 - 7 μ.

**Erysiphales**

**Erysiphe** Hedw. f.ex DC.

Spores hyaline, single celled, ovate with flattened ends, surface may be smooth to granular, spores sometimes found in chains, Spore size varies from 9 - 15 x 5 - 7 μ.

**Sordariales**

**Chaetomium** Kunze.

Ascospores simple, hyaline to dark brown in colour, lemon shaped, single celled, smooth walled. Spore size varies from 7 - 15 x 5 - 8 μ.
Ascospores

Spores usually single or in clumps of 8, colours range from light brown, dark brown, black, green, grey or hyaline, spores range from unicellular, ovoid, elliptic to bicelled or multicellular forms of variable shapes such as filiform, septate and fusoid types, spore size varies from 5 - 50 μ.

Basidiomycotina

Hymenomycetes

Ganoderma P. Karsten.

Basidiospores brown, ellipsoid, ovoid, somewhat elongated and distinctly truncated at the distal part, single celled, surface foveate, wall consisting of an episporium, a thick brown exosporium with hyaline irregular cavities of a perisporium and an ectosporium. Spore size is 6.5 - 8.5 (9.5) x 4.5 - 6 μ.

Uredinomycetes

Uredospores

Spores yellow, brown to golden brown, ellipsoid or oblong - ellipsoid with (3-4) germ spores at the equator, wall smooth or echinulate, 20 -40 μ long and 13 -24 μ broad.

Teleutospores

Spores reddish brown, 2 celled, radially symmetrical, long stalked, thick walled, smooth or verrucose, with one or
more germ pores. Spores 25 - 60 μ in length.

**Ustilaginomycetes**

**Smut spores**

Spores yellow brown to dark brown, spheroidal, single celled, thick walled, wall may be minutely echinulate, verrucose to strongly reticulate. Size varies from 5 - 20 μ in diameter.

**Basidiospores**

Spores unicellular with a wide range of colours ranging from hyaline, pale to brightly coloured forms, spores may be symmetric or asymmetric, ellipsoid to ovoid, elongate - ellipsoid, fusoid, tuberculose - angular or polyhedral, spores marked by a basal opiculus, wall smooth or nearly so, size 4 - 8 μ.

**Deuteromycotina**

**Coelomycetes**

**Botryodiplodia** Sacc.

Conidia dark brown, ovoid to elongate, 2 celled, smooth walled, size 20 - 30 x 5 - 7 μ.

**Haplosporella** Speg.

Conidia dark brown, ovoid to oblong, one celled, large, 30 - 40 x 7 - 10 μ.
Pestalotia de Not.

Conidia brown, ellipsoid to fusoid, 3 septate with hyaline pointed end cells and two or more hyaline apical appendages. Size of conidia varies from 25 - 35 x 3 - 5 μ.

Hypomycetes

Alternaria Nees ex Fries.

Conidia solitary or catenate, pale to dark brown in colour, variable in shape from obclavate to ellipsoid or ovoid, muriform with transverse, longitudinal and sometimes oblique septa, number of septa variable, may or may not be constricted at septa, spore body provided with a beak which may be poorly developed or filiform without longitudinal walls, apex of the beak with scar, conidia surface warted, echinulate or apparently smooth, size ranges from 20 - 60 x 9 - 18 μ.

Arthriniurn Kunze ex Fries.

Conidia 1 celled, pale to dark brown in colour, sessile, flattened and drawn out into the shape of an elongated diatom, concave - convex in shape, 7.25 μ in diameter, 4.4 μ thick.

Aspergillus - Penicillium

Conidia one celled or in dry basipetal chains readily
coming apart, colour varying from hyaline, pale green, yellow, brown to black, conidia single celled, globose or oval, smooth or with markings on the wall, size 3.5 - 5 μ in diameter.

**Beltrania Penzig.**

Conidia unicellular, biconic, brown with a subhyaline equatorial band, usually bearing a long conical one celled hyaline septa at the apex, rounded or denticulate at base, size varies from 13-25 x 8 - 12 μ.

**Bispora Corda.**

Conidia subfusiform, acute at both ends, one septate, pale in colour, conidia in chains.

**Camptomeris Syd.**

Conidia subhyaline to light brown in colour, oblong, obclavate to obpyriform, rounded at the base with a distinct scar of attachment, distal portion narrowed to an obtuse beak which is straight or curved, conidia 3 septate, walls conspicuously roughened, conidia size 20 - 33 x 6 - 8 μ.

**Cercospora** Fres.

Conidia hyaline, greenish to brownish in colour, acicular or filiform, straight or curved, septate, abconic
or truncate at the base, acute or obtuse at the apex, septate wall smooth, variable in size from 25 - 35 x 3 -6 μ.  

**Cladosporium** Link ex Fries.  

Conidia subhyaline to dark brown, found singly or in simple or branched chains, easily separating, polymorphous, globular, oval, oblong, cylindrical or obtuse. Conidia 1 - 3 septate, wall smooth, finely verrucose with hila, 5 - 28 x 3 - 8 μ.  

**Corynespora** Gussow.  

Conidia solitary or in short chains in acropetal succession, pale brown becoming little darker with age, with a thin coloured pellicle, thick colourless exospore and a prominent dark, annular, basal hilum. Conidia pyriform, obclavate or multiseptate, wall smooth, size 46 - 65 x 8 - 15 μ.  

**Curvularia** Boedijn.  

Conidia pale to dark brown, ellipsoid or cylindrical or curved, ends rounded, base sometimes having protruding hilum, conidia 3 - 4 septate, one of the central cells being larger and darker, wall usually smooth or variously verrucose. Spore size variable from 21 - 48 x 8 - 20 μ.
Endocalyx Berk & Br.

Conidia one celled, brown, flattened, ovoid to irregular with a longitudinal germ pore slit on one side, wall verrucose, Spore size 10 - 18 x 5 - 8 μ.

Epicoccum Link ex Wallroth.

Conidia golden brown, brown or black in colour, sub globose or irregular angular shaped, irregularly septate, muriform with upto 15 cells, epispore is thick and aerolate, verrucose at the distal ends and with a lighter, less verrucose, basal cell. Conidia measure 7 - 65 x 6 - 53 μ.

Exosporium Subram.

Conidia typically obclavate, broadest towards the base, becoming much narrower and tapering above, brown, verrucose, 10 - 20 septate, thick walled, straight or often curved variously, 90 - 200 μ long, 22 - 27(-33) μ where they are broadest and 5 -7 μ broad at the apex, with scar of point of attachment.

Fusarium Link ex fries.

Conidia hyaline to subhyaline, sickle shaped often with distinct pediculate base and obtuse apical tip, 3 to many septate, conidia may be 25 - 120 μ long and 2 - 9 μ wide.
Gliomastix (Corda) Hughes.

Conidia subglobose, Yellow-brown in colour due to black deposit around the exospore, the deposit giving the false appearance of wartiness, 2.5 - 4.5 x 2.3 - 3 μ in size.

Helminthosporium Link ex Fries.

Conidia single, subhyaline to brown, cylindrical, obclavate, slightly curved, 5 - 6 pseudosepta, spore with basal scar. Spore size 50 - 75 x 7 - 2 μ.

Heterosporium Klotzsh.

Conidia brown, cylindrical, 3 to many celled, invariably 3 septate, cells swollen and constricted at the septa, median cell barrel shaped, end cells hemispherical, wall often echinulate or verrucose, conidia 30 - 40 x 16 - 22 μ.

Memnoniella Hohn.

Conidia catenate in persistent single chains upto 200 um long, conidia opaque, black, globose, angular, disc like, walls rough, 5 - 5.5 μ wide and 3.5 - 4 μ thick.

Monodictys Hughes.

Conidia oblong with rounded ends to oval or pyriform, sometimes globose, multicellular with regular or more often
irregular septation, fuscous, with one or more basal cells or conidia sometimes much paler than the remaining cells, sometimes constricted at septa, 16-37 x 14 - 32 μ in size.

**Nigrospora** Zimm.

Conidia Jet black, opaque, single celled, depressed globose, elliptical when viewed from the side, 10 - 35 μ in diameter.

**Periconia** Tode ex Schw.

Conidia one celled, brown, globose, wall thick, verrucose, minutely echinulate or beset with numerous spine like appendages, conidia 10 - 20 μ in diameter.

**Phaeotrichoconis** Subram.

Conidia dark brown, elongate, fusiform with a long appendage at the apex and a prominent dark scar marking the point of attachment, 5 - 8 septate, not constricted at the septa, thick walled, second or third cell from the base larger than the rest, slightly curved, longer than the conidium body, 119.4 - 127.5 μ long.

**Pithomyces** Berk & Br.

Conidia pale to dark brown, variable in shape ranging from oval, obovoid, clavate, oblong, pyriform. Conidia
usually 3 septate with one or more longitudinal septa, wall usually verrucose to echinate occasionally smooth 20 - 35 x 7 - 10 μ.

**Scopulariopsis** Bainier.

Conidia hyaline to subhyaline, one celled, nearly pyriform to globose with a truncate base encircled by a minute frill, thick walled, tuberculate, 6.5 - 7.5 x 7.5 - 9 μ.

**Spegazzinia** Sacc.

Conidia dark brown, flattened, 4 celled rarely 8 celled, i.e. cruciately arranged to form a square, deeply constricted at the septa. Conidia may be smooth with edges irregularly lobed or spiny, 18.7 - 25.5 μ long and wide and 9 - 10 μ thick.

**Sporidesmium** Link ex Fries.

Conidia pale brown to dark brown, elongated, obclavate, straight or bent, having either numerous septa or pseudosepta constricted at the septa, thick walled with a distinct flat basal scar. Conidia 70 - 210 μ long and 10 - 15 μ at the widest part.
**Stachybotrys** Pulchra Speg.

Conidia ellipsoidal, 10 - 15 μ long, 5 - 6 μ wide, minutely granular, 1 celled, dark in colour.

**Stemphyllium** Wallr.

Conidia pale to dark brown, opaque, globose, oblong to broadly ellipsoid, rounded at ends, muriform with several horizontal, vertical and oblique septa, usually strongly constricted at the mid horizontal septum, wall smooth to verrucose. Conidia 27 - 42 x 24 - 30 μ.

**Tetraploa** Berk & Br.

Conidia brown, four armed, consisting of 3 - 4 initial cells, each developing into a long attenuated, septate appendage, smooth or rough. Conidia measuring 80 - 96 x 5.5 - 10 μ.

**Torula** (Pers.) Link ex Fries.

Phragmospores, often in bits of 1, 2 or 3 cells, deeply constricted at septa, wall markedly echinulate to warty, conidia 4 - 10 μ wide in the widest part.

**Trichoconis** Clem.

Conidia creamy yellow to pale brown, elongately fusoid with a long appendage at the tip which is non-deciduous.
PLATE III - Figs. a–o

Photomicrographs of some of the airborne fungal spores trapped during the aerobiological survey

a. Alternaria x 1000
b. Basidiospore x 1000
c. Cladosporium x 1000
d. Curvularia x 1000
e. Delitschia x 1000
f. Didymosphaeria x 1000
g. Ganoderma x 1000
h. Helminthosporium x 1000
i. Leptosphaeria x 1000
j. Nigrospora x 1000
k. Periconia x 1000
l. Pleospora x 1000
m. Smut spores x 1000
n. Torula x 1000
o. Uredospores x 1000
columella present; spores spherical or ellipsoid, thin walled, colourless.

**Rhizopus** Ehrenberg.

Colonies cottony, pale brown in colour. Aerial mycelium forming arching filaments, stolon are raised from the substrate and implanted at each node by means of rhizoids. Internodes may be 1 - 3 cm and the hyphae are more or less branched. Sporangiophores arise at the nodal point in groups of 3 - 5 or more. Apophyses broad, cuneiform. Sporangia hemispherical, 100 - 350 μ. Columella broad, hemispheric, depressed. Spores unequal, oval, angular, striate, light grey - blue in colour, 5 - 12 μ long and 7.5 - 8 μ in diameter.

**Ascomycotina**  
**Dothideales**  
**Sordariales**  
**Chaetomium** Kunze.

Perithecia scattered or gregarious, broadly ovate or ellipsoid, 250 - 300 x 200 - 250 μ dark brown, membranous, thickly and evenly coated with slender, flexuous hairs. Apical hairs are coarser than others, sparingly septate, minutely scabrous, 3 - 4 μ thick, often 700 μ long. Asci oblong - clavate, evanescent; spores dark, ovate, faintly apiculate at both ends, 8 - 9.5 x 6 - 8 μ.
Deuteromycotina

Coelomycetes

Melanconiales

Pestalotia de Not.

Acervuli dark, discoid or cushion shaped, subepidermal; conidiophores short, simple; conidia dark, several celled, with hyaline pointed end cells, ellipsoid to fusoid, with 2 or more hyaline, apical appendages.

Sphaeropsidales

Sphaeropsidaceae

Botryodiplodia Sacc.

Pycnidia black, ostiolate, erumpent, stromatic, confluent, conidiophores simple, conidia dark and 2 celled at maturity, ovoid to elongate.

Phoma Desm.

Pycnidia dark, ostiolate, lenticular to globose, conidiophores short, conidia small, one celled, hyaline, ovoid to elongate.

Hyphomycetes

Moniliales

Moniliaceae

Aspergillus Link.
Conidiophores upright, simple, terminating in a globose or clavate swelling, bearing phialides at the apex or radiating from the entire surface; conidia (phialospores) 1 celled, globose, often variously coloured in mass, in dry basipetal chains.

**Monilia** Pers.

Mycelia white or grey, conidia (blastospores) pink, grey, or tan in mass, one celled, short cylindric to rounded in acropetalous branched chains, conidiophores branched, its cells differing little from the older conidia.

**Penicillium** Link.

Conidiophores arising from the mycelium singly or less often in synnemata, branched near the apex, penicillate, ending in phialides; conidia (phialospores) hyaline or brightly coloured in mass, 1 celled, mostly globose or ovoid, in dry basipetal chains.

**Scopulariopsis** Bain.

Conidiophores mostly branched or producing at the apex a cluster of sporogenous cells which elongate before producing succeeding conidia, leaving annellations at the tip; conidia (annellospores) hyaline or subhyaline, 1 celled, globose with a truncate base, produced in basipetal chains; colonies other than green or blue.
**Trichoderma** Pers.

Conidiophores hyaline, much branched, not verticillate; phialides single or in groups; conidia hyaline, 1 celled, ovoid, borne in small terminal clusters; usually easily recognised by its rapid growth and green patches of conidia.

**Gliocladium** Corda.

Conidiophores hyaline, the upper portion bearing penicillate branches, forming a compact "brush" as in penicillium; conidia hyaline or brightly coloured in mass, 1 celled, produced successively apically and collecting in mucilaginous droplets.

**Verticillium** Nees.

Conidiophores slender, branched, at least some of the branches verticillate, conidia ovoid to ellipsoid, hyaline, 1 celled, borne singly or in small moist clusters apically.

**Dematiaceae**

**Alternaria** Nees.

Conidiophores dark, mostly simple, rather short or elongate, typically bearing a simple or branched chain of conidia; conidia (porospores) dark, typically with both cross and longitudinal septa; variously shaped, obclavate to elliptical or ovoid, frequently borne acropetally in long
chains, in some instances borne singly and having an apical single or branched appendage.

*Bispora* Corda.

Mycelium dark; conidiophores dark, short, single or sparingly branched, conidia (blastospores) dark, oblong to ellipsoidal, 2 celled or less often 3 celled, with thick black septa; produced in acropetalous chains.

*Cladosporium* Link.

Conidiophores tall, dark, upright, branched variously near the apex, clustered or single, conidia dark, 1 or 2 celled, variable in shape and size, ovoid to cylindrical and irregular, some typically lemon shaped; often in simple or branched acropetalous chains.

*Curvularia* Boedijn.

Conidiophores brown, mostly simple, bearing spores apically or on new sympodial growing points; conidia dark, end cells lighter, 3 - 5 celled, more or less fusiform, typically bent, with one of the central cells enlarged.

*Epicoccum* Link.

Sporodochia dark, more or less cushion shaped, variable in size, conidiophores compact or loose, dark, rather short, conidia dark, 1 celled (dictyosporous), globose.
**Geotrichum** Link.

Mycelium white, septate, conidiophores absent; conidia (arthrospores) hyaline, 1 celled, short, cylindrical with truncate ends, formed by segmentation of hyphae.

**Helminthosporium** Link ex Fr.

Mycelium dark, often in substrate; stromata often present; conidiophores single or clustered, tall erect, brown, simple, conidia developed laterally through pores beneath septa while apex of conidiophores is still growing, often appearing in whorls, single, subhyaline to brown, obclavate, phragmosporous, pseudoseptate, with prominent basal scar.

**Humicola** Traaen.

Conidiophores simple or rarely with short branches, dark; conidia single apical, globose or subglobose, brown, 1 celled; some species also producing simple phialides and phialospores in chains.

**Nigrospora** Zimm.

Conidiophores short, mostly simple, conidia black, 1 celled, globose, situated on a flattened, hyaline vesicle at the end of the conidiophore.
**Periconia** Bon.

Conidiophores dark, tall, upright, stout, simple, some enlarged at apex which bears a loose head of conidia, conidia dark, 1 celled globose in dry chains, arising from globose sporogenous cells.

**Pithomyces** Berkeley & Broome.

Mycelium pale to brown; conidiophores short, simple, peglike, arising laterally from mycelium, subhyaline; conidia single, apical, mostly several celled, mostly broadly elliptical, oblong to pyriform or irregular, commonly verrucose or echinulate; usually detached by fracture of wall of conidiophores.

**Pseudotorula** Subram.

Conidiophores dark, simple, torulose, with apical rounded sporogenous cell; conidia of two types, brown, 4 celled spores in acropetalous chains, and long, slender, several celled spores.

**Stachybotrys** Corda.

Conidiophores subhyaline to dark, simple, bearing at apex a cluster of thick, short, phialides; conidia dark, 1 celled globose to ovoid, borne in moist heads at the apex of the phialide, not catenulate.
Stemphyllum Wallr.

Conidiophores dark, mostly simple with darker terminal swelling, short to long, bearing a single, terminal conidium, or successive conidia on new growing tips, conidiophore proliferating through old conidial scar; conidia dark, with cross and longitudinal septa, variable in shape, frequently globose to broadly ellipsoid, or ovoid, smooth, verrucose or echinulate.

Torula Pers.

Conidiophores short or lacking, entire branches developing into simple or branched erect chains of dark globose conidia which separate readily into one to several celled segments.

Trichocladium Harz.

Conidiophores short or lacking; conidia (aleuriospore) dark, transversely one to four septate, ovoid to ellipsoid to clavate.

Stilbaceae

Endocalyx Berk & Br.

Synnemata expanding upward into a funnel which is filled with conidia; conidia sessile or on short branches of conidiophore, 1 celled, brown, flattened, ovoid or irregular, with a germ slit.
Tuberculariaceae

Fusarium Link.

Mycelium extensive and cottony, often with some tinge of pink; conidiophores variable, slender and simple, or stout, short, branched irregularly or bearing a whorl of phialides, single or grouped into sporodochia; conidia hyaline, variable, principally of two kinds, often held in small moist heads; macroconidia several celled slightly curved or bent at the pointed ends, typically canoe-shaped; microconidia one celled, ovoid to oblong, borne singly or in chains; some conidia intermediate, two or three celled, oblong or slightly curved.

Myrothecium Tode.

Sporodochia cushionlike sometimes with marginal hyaline setae; conidiophores subhyaline to coloured, repeatedly branched bearing conidia terminally; conidia subhyaline to dark one celled, ovoid to elongate, dry in mass.

Tubercularia Tode.

Sporodochia rather large, light to orange in colour, conidiophores hyaline, elongate, repeatedly branched, not verticillately, bearing conidia terminally; conidia hyaline, one celled ovoid to elongate, in a dry mass on the surface of the sporodochium.
Photomicrographs of airborne fungal spores trapped during the culture plate exposure

p. Alternaria  x 400
q. Aspergillus  x 400
r. Cladosporium  x 400
s. Fusarium  x 400
t. Phoma  x 400
u. Rhizopus  x 400
d) METEOROLOGICAL OBSERVATIONS

Bangalore, without the extremes of temperature enjoys a salubrious climate throughout the year, thus acquiring the name of being the "Air-conditioned City" of India. The meteorological data during March 1991 to May 1993 showed the mean minimum temperature to vary on an average from 13.8°C in the coldest month to 22.1°C in the hottest month. The mean maximum temperature varied on an average from 25.8°C to 34.4°C. The average relative humidity ranged from 34.5% to 81.5%. Rainfall was moderate, with the months between May to October receiving the maximum amount. Winds were generally light, becoming strong during South-West monsoon i.e., June to August (Table 3).

Three principal seasons were observed - Winter, Summer and Monsoon.

Winter

It is relatively mild extending from November to early February, January being the coldest month. The lowest minimum average temperature of 13.8°C was recorded in January 1992 when the maximum average was 26.7°C. The relative humidity ranged from 54.5% to 75.5%. Winter months are generally dry. The course of wind in November and December is mainly from the north east and east while later
in January and February the course of wind changes and blows from north east and south west.

Summer

The Summer starts from late February and extends to May, April being the hottest month. The mean maximum temperature of $34.4^\circ$ C was reached in April 1992 when the mean minimum was $21.5^\circ$ C. Summer months are relatively dry. However rainfall of 43.3mm and 38.8mm were recorded during April 1991 and 1993 respectively. The winds during this period are generally south westward and westward.

Monsoon

The monsoon commences from the last week of May to October with few showers in November. This includes the south west and north east monsoons. The south west monsoon sets in during the early part of June and reaches a peak in September. Strong winds prevail during the south west monsoon. The wind then changes its direction and the north east monsoon starts and becomes active during October to November. The yearly highest rainfall of 303mm and 159.8mm were recorded in the month of October during 1991 and 1992 respectively. The relative humidity reaches its maximum and the highest average relative humidity 81.5% was recorded in August 1991 and 1992. The close of monsoon was usually marked by a few days of mist.
Table 3: Meteorological data on monthly mean temperature, relative humidity, wind speed & total rainfall from March 1991 to April 1993.

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