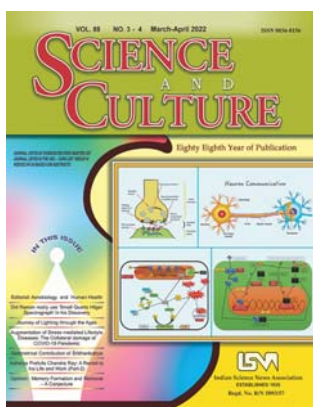


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EDITORIAL

AEROBIOLOGY AND HUMAN HEALTH



The atmosphere is a mixture of various gases including bioparticles such as pollen grains, fungal spores, insect scales, hairs, dander, hyphae fragments, leaf cuticles and fibers, etc. The study of bioparticles is termed as “Aerobiology” which was coined by Fred C. Meier of U.S.A in 1930’s that embraces studies of fungal spores, pollen grains and bacteria in the atmosphere. Where as Gregory (1952) termed “Airsports” to describe the study of airborne pollen grains, fungal spores, hyphal fragments, parts of plants such as trichomes, scales, fibers and insect scales as aeroallergens which originate from different sources mentioned in Table-A.

The size of airspora varies from 0.02 μ m (or less) in viruses to 100 μ m or several centimeters (Edmonds 1979). The two major events which has been dealt with in the study of atmospheric bio-pollutants are: dispersal of the significant substances with varied dimension and quantitative and qualitative estimation of these substances on the biological system.

Airborne biological particles are named as aeroplankton whereas gases containing floating dusty particulates are called aerosols. The term Aerobiology thus embraces not only the study of airborne bioparticulates but also the pollution by gases that exert specific biological effects. The aerobiological process is concerned with the source of an organism or material, their release in the atmosphere, flight or dispersion, deposition and impaction on animals and human systems. The

interdisciplinary science “Aerobiology” though it gained unique attention and importance in recent years, started as early as 1849 when Ehrenberg collected micro-organisms from the air. Later on such studies were initiated by many scientists throughout the world. Of all the applications of the aerobiological study, the most significant application is in human physiology in causing the various types of allergic manifestations such as upper-tract respiratory allergy, naso-bronchial allergy, seasonal allergic rhinitis, bronchial asthma, atopic dermatitis and eczema. Blackley in 1873 proved by conducting experiments on him that grass pollen causes hay fever. Aerobiology deals with the analytical aspect of allergy, its manifestation and mechanism of control. All the pollen grains occurring in the atmosphere do not cause allergy. The pollen grains which cause allergy have to fulfill certain basic requirements stated by Thommen (1931) such as: (i) They should contain an excitant to cause allergy, (b) They should be wind pollinated, (c) They should be buoyant enough to be carried away easily by wind, (d) They should be produced in huge amount, and (e) The plant producing such pollen grains must be widely and abundantly distributed.

Researches carried throughout the world (Hyde, 1956 a & b; Hamilton, 1959; Shivpuri *et al.* 1960b) have proved the correctness of above statement. The airspora of a particular region is directly related to the vegetation pattern of the area for investigation (Scheppegegel, 1961). The behavior of airspora i.e. the distribution of airborne pollen grains/spores are greatly influenced by the meteorological factors such as temperature, humidity, wind direction, wind velocity and rain fall. These factors have direct influence on the pollen season severity (Andersen, 1980). The common samplers conventionally used for trapping airspora include:

- Rotorod Sampler
- Burkard seven day volumetric sampler
- Burkard one day personal sampler
- Andersen two stage sampler.

Table-A : Common Aeroallergens (Finkelstein, 1969)

Aeroallergens	Source
Pollen	Wind pollinated plants: grasses, weeds and trees
Molds	Usually saprophytic, prevalence depending upon humidity, temperature and substrate distribution.
Dander	Feathers of chickens, geese, ducks; hair of cats, dogs, horses, sheep, cattle, laboratory animals and human beings.
House Dust	A composite of all dusts found in the home-probably has specific components related to mites, algae etc.
Misc. vegetable fibers and dusts	Cotton, Kapok, flax, hemp, jute, straw, castor bean, coffee bean, rye, wheat.
Cosmetics	Wave set lotions, talc, perfumes, hair tonics
Insecticides	Insecticides containing pyrethrum as a common ingredient
Paint, varnishes and glues	Linseed oil and organic solvents may be primary irritants, fish proteins in glues still important

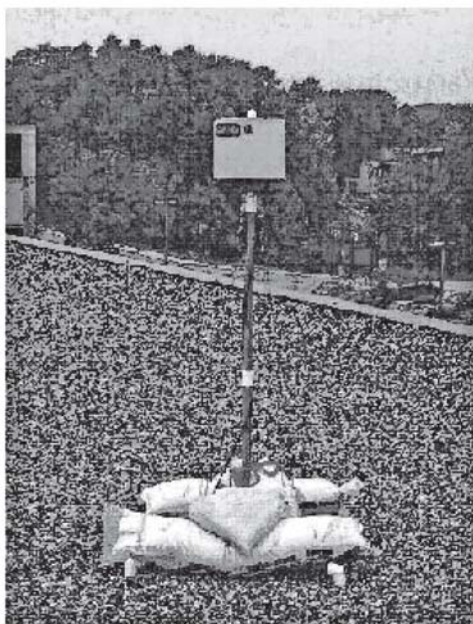
The study of airborne particles dates back to 1729 when Micheli undertook the airborne pollen investigation. Later scientists from different parts of the world



Burkard seven day volumetric sampler



Burkard one day personal sampler



Rotorod Sampler



Andersen Sampler

concentrated on this interesting branch of science which has its application in many fields like allergy and immunology, plant pathology, meteorology, disease forecasting. Ehrenberg worked on the airspora of Germany in 1849. Pasteur (1861) demonstrated the existence of microbial organism in the air. Blackley (1873) was the first to prove grass pollen grains as the causal agent of hay fever. The first report of a comprehensive aerobiological work in India was published in 1873 by Cunningham dealing with the airspora over the Kolkata Jail, the then capital of India, in view of its increasing urbanization. In 1980 aerobiologists from different parts of India assembled to attend the "Workshop on Modern Trends in Aerobiology with particular reference to Plant Pathology and Medicine" held at the Bose Institute, Calcutta, where the Indian Aerobiological Society (IAS) was formed and started functioning from 31st January, 1980. Modern aerobiological approach also takes into consideration the man made and natural pollutants that affect adversely the viability of microorganism present in the air and soil. The field has become more fascinating with new capabilities of spread of plant and animal diseases in various directions.

Aerobiology is a multidisciplinary science of applied significance, which is a synthesis of human, plant and animal pathology, immunology, ecology, microbiology, biodeterioration, etc. This subject deals with the investigations of airborne organisms of both outdoor and indoor environments which are composed of pollen grains, fungal spores, microscopic fragments of plants and animals, small insects, algal fragments, bacteria and others. The aerobiological pathway includes source, release, transport, deposition and impaction of these organisms on plants and animals including human being. The frequency of allergic diseases, phytopathological impactions and crop epidemiology assume much higher dimension in our country where details of airborne pathogens are not well known. As such, aerobiology has got a great potentiality for research and development in India.

In recent years, the way of doing research has changed much and the easy and swift means of communications between scientists and institutes have enabled the creation of several groups each one following a precise scientific view. The information exchange enables an ever increasing number of scientists to compare procedures, evaluate ideas, clear up and deepen the fundamentals (principles and methodologies) of aerobiology. Pollen-spore allergy is one of the most important problems of human pathology all over the world. About 15-20% of the world's population are suffering from allergic disorders i.e. allergic rhinitis, bronchial asthma,

atopic dermatitis and urticaria. Pollen allergy is caused by proteins, glycoproteins or even a single peptide which are present in the pollen wall and cytoplasm. Thus, the detection of the site of origin, isolation and characterization of allergy causing proteins or glycoproteins is now a very challenging task for aerobiologists. A study of pollen biochemistry can provide basic data to aerobiologists and allergologists, which can help them understand the role played by the various chemical constituents of pollen in the allergic manifestations.

The term "Allergy" was coined by von Piquet (1906) and defined it as an acquired, specific, altered capacity of the immune system to react against a subsequent exposure to which the body has already become sensitized. In recent years the term allergy has become synonymous with type I hypersensitivity. Allergic reactions are dependent on the specific antibody, i.e. immunoglobulin E (IgE) which binds with high affinity to the surface of mast cells and basophils. A later exposure of the same allergen cross-links the membrane IgE on mast cell and basophils, causing degranulation of these cells, resulting in release of the mediators (histamines). The principal effects are vasodilation and smooth-muscle contraction, may be systemic or localized, depending on the extent of mediator released. Asthma is a chronic lung disease that affects more than 17 million Americans and 100 million Indians. Allergic rhinitis is considered a risk factor in developing asthma: upto 78% of those with asthma also has allergic rhinitis.

The idea of skin test for the diagnosis of allergic disorders came after the introduction of a cutaneous test for tuberculosis by von Pirquet. Though the intradermal skin test is more sensitive and reliable, but the skin prick test is found to be more convenient. Several *in vitro* techniques are also used for allergy diagnoses, which include Radio Allergo Sorbent Test (RAST) and Radio Immuno Sorbent Assay Test (RIST). But Enzyme Linked Immuno Sorbent Assay (ELISA) developed is cheaper and easy to handle than RAST and RIST. At present, diagnosis should be based on careful clinical history supported by documentation of IgE mediated sensitivity by the skin prick test along with one of the *in vitro* tests.

The first step is to identify the offending allergen. Immunotherapy through hypo-sensitization with repeated injections of increasing doses of allergens has been known to reduce the severity reaction of individuals. Knowledge of mechanism of mast cell degranulation and the mediators involved in allergic reaction opened the way of drug therapy for allergens. Antihistamines have been the most useful drugs for symptoms of allergic rhinitis. Several

drugs blocks release of allergic mediators by interfering with various biochemical steps in mast cell activation and degranulation. The tools for allergy therapy are the allergenic extracts made from allergen collected from natural sources. Allergen extracts have been used to proper diagnosis and treatment of allergy over 50 years. Despite this, little is known concerning the nature of these materials. The remarkable heterogeneity has often resulted in unreliable diagnosis, ineffective therapy and other side effects. So, there is a need for standardization of allergenic extracts for immunotherapy. The Allergen Standardization Committee of the International Union of Immunological Studies (IUIS) took the responsibility for the production of allergenic extracts that would meet specifications for international standard preparation as per WHO.

Certainly the credit for the promotion and dissemination of this kind of study goes to the IAA (International Association for Aerobiology), an association that since its foundation has been growing rapidly, and in the last three decades it has changed from an association of members to an association of associations. As a matter of fact, in the last thirty years or so, various national associations of aerobiology have been founded, which locally have been fostering and promoting aerobiological studies. In Europe the first created NAF (Nordic Aerobiology Federation) has been established followed by the AIA (Association of Italian Aerobiology), SOFRAB (French Association of Aerobiology), BAF (British Aerobiology Federation), REA (Spanish Aeroallergen Network) and the Schweizerische Gesellschaft für Aerobiologie (SCA), in India the IAS (Indian Aerobiological Society) and in America the PAAA (Pan American Association for Aerobiology) have been founded. Aerobiology is composed of many disciplines, but the development of each one is far from being balanced today.

IAS has successfully completed its 42nd years of existence. To be precise IAS was formed on 31st January 1980 at the Bose Institute, Kolkata under the dynamic leadership of Prof. Dr. Sunirmal Chanda, in the gracious

presence of Prof. Siwert Nilsson, Swedish Museum of Natural History, Stockholm, Sweden, Prof. S.T. Tilak and many others. Prof. Chanda was elected unanimously as the first President. A society which started with 36 members, has now more than 500 members (life and annual) and the membership is steadily increasing. The society is affiliated to International Association for Aerobiology. It is gratifying and worth mentioning here that the founder-President Prof. Chanda was also elected as the President of the International Association for Aerobiology and presided over the 4th International Conference on Aerobiology at Stockholm in August 1990. Needless to mention that this is a distinct honour conferred on an Aerobiologist outside Europe and America. It is to be mentioned here that the present Editor-in-Chief, *Science and Culture*, Prof. Dr. Sudhendu Mandal, has also to be credited for successful conduction of the 13th National Conference on Aerobiology at the Institute of Science, Nagpur in 2005 and 14th National Conference on Aerobiology at Pt. Ravishankar Shukla University, Raipur, Chhattisgarh in 2007 as President of IAS for two consecutive terms (2003-2005 and 2005-2007).

Finally it can be stated that the study of airborne airspora is significant as (a) It contributes in advance research and education in aerobiology and allergy, (b) It will cater the proper diagnosis of the agents responsible for initiating widespread allergic diseases and also for developing effective therapeutic measures against these diseases, and (c) The present work will also be more significant for better understanding of the airborne biological particles that cause severe damage to agricultural and horticultural crops. Thus the aerobiological research encompassing the information of atmospheric biopollutants will make a breakthrough in multidisciplinary approach for the subject aerobiology highlighting all related aspects which may be useful for the benefit of human population. □

Sudhendu Mandal
e-mail: chiefeditorscienceandculture@gmail.com