



Hawaii: an ideal model for international aerobiological research

Harold E. Schlichting, Jr.

BioControl Company, Inc., Port Sanilac, USA and St. Mary's College, Orchard Lake, USA

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Abstract

Future aerobiological studies important to mankind's understanding of our planet must demonstrate the ecological interrelationships between the aerial biota of island ecosystems and meteorological, chemical, physical and geographic factors. For example, air quality as related to human health and plant pathology can be more easily ascertained using oceanic islands such as Hawaii with the establishment of an international interdisciplinary aerobiological research team.

1. Atmospheric global monitoring

The International Council of Scientific Union (ICSU) called a Constitutional Convention for the International Biological Program (IBP) in Paris in 1964. About 20 years ago the Third General Assembly of the IBP appointed an ad hoc committee to study the feasibility of establishing a global network environmental monitoring system. The concept of a global monitoring system to discern air, water and soil quality was in response to the threat of increased environmental pollution. Originally it was thought that a permanent global monitoring system must be the task of an international intergovernmental agency (United Nations) and national governmental agencies.

Conferences were convened in the United States to plan the overall strategy for atmospheric monitoring (Edmonds, 1979). The international scientific community presented plans in the United States, Sweden and the Soviet Union for global monitoring at the 1972 United Nations conference in Stockholm. In the same year ten Houten (1972) of the Netherlands published a brief but useful book entitled *Aerobiologie* and the US / IBP Aerobiology Program Synthesis Volumes, edited by R. L. Edmonds and W.S. Benninghoff (1973 II & III) were published. During the 1970's some national atmospheric studies were conducted but, due primarily to the lack of funding, progress for

international and coordinated national aerobiological studies in most nations came to a standstill.

Perhaps now is the time to resurrect plans for the international global monitoring of air quality. The success of such a venture will depend for the most part upon the cooperation of national atmospheric research centers and aerobiologists, meteorologists, air chemists and physicists and their professional organizations such as the International Aerobiology Association and the Pan American Aerobiology Association. It is also imperative to have input from instrument manufacturing companies. Utilizing their expertise to combine their most efficient specific type of samplers into portable "modular units" would be a valuable contribution. These units placed on bouys, ships, aircraft and permanent or mobile land sampling stations would sample air chemistry and biological particulates from varied habitats.

Benninghoff (1991), Chanda (1991) and Lebowitz and O'Rourke (1991) strongly emphasized the importance of monitoring meteorological and aerobiotic parameters and air chemistry to improve our understanding of indoor and outdoor air quality and to discern its impact on plant, animal and human health. Tiberg (1989, Tiberg et al., 1983) has contributed to our knowledge of microalgae as allergens and Rivera F. et al. (1992), Rosas I. et al. (1987) and Roy-Ocotla G. and Carrera J. (1993) have recently

conducted significant studies of airborne microalgae and Protozoa in Mexico.

2. Hawaii as an ideal model for aerobiological research

Ecological interrelationships between the aerial biota and meteorological, chemical, physical, geographic and topographical factors, as related to environmental quality and human health, can probably be more readily ascertained in Hawaii than anywhere else in the world. The research of Brown (1971) and Carson and Brown (1976) on aerial and terrestrial microalgae dispersal in Hawaii is an excellent foundation for the establishment of an international interdisciplinary research effort as an early step in the formation of a global atmospheric monitoring network.

The Hawaiian Islands of Oahu and Hawaii would provide ideal model systems for studying the release, dispersion, deposition and impact of the aerial biota upon an island ecosystem. Factors which make them suitable are their isolation from continental land masses (approximately 3200 km), the consistent nature and high predictability of their meteorological conditions and the northeast trade winds reaching the islands being relatively free of biological particulates (Bernstein and Safferman, 1972; Brown, 1972; Schlichting et al., 1972).

Brown's studies indicated that aerial microalgae over the islands arise locally throughout the islands and are dispersed on both an inter-island and intra-island basis. In the island transect across Hawaii from Hilo, through the Hawaii Volcanoes National Park area to South Point, a distance of about 80.5 km, the altitudinal changes range from sea level to approximately 6,500 ft (1980 M). Distinct meteorological differences occur with heavy rainfall at the lower elevations. These differences are due to the mountain Mauna Loa absorbing great quantities of heat during the day forming updrafts of air toward the summit. The updrafts contain moisture that can cause distinct temperature and humidity gradients. Prevalent volcanic gases, especially sulfur and nitrogen oxides near the middle of the transect would likely prevent the culturing of some microorganisms (Carson and Brown, 1976).

Probably the most interesting transect for most aerobiologists to study would be the Pali Highway transect across the island of Oahu. The transect is 14 miles (22.5 km) across the island going from

Honolulu harbor to the Pali Lookout and to Kailua Beach. The altitudinal changes are from sea level to about 1200 feet (366 M). Brown's transect studies (1971) demonstrated that only at Kailua Beach were the aerial samples devoid of microalgae and that the fallout peaks occurred on the windward and leeward sides of the island.

Microalgae of sufficient diversity and numbers seemed relatively easy to collect and relate to environmental parameters.

The importance of aerial sampling along highways was inferred by H. M. Brown's (1991) statement "Pollen allergic patients often develop severe symptoms during and after driving on English motorways". The research of Villalobosa-Pietrini (1992) and Rosas et al. (1982) substantiated the idea that air pollutants and biological particulates combine and can cause severe allergic reactions in Mexico which may also prove to be true in Hawaii.

3. Conclusions

The Hawaiian Islands seem to be excellent sites for aerobiological studies due to the high degree of predictability of meteorological conditions and the relatively less complex aerial biota. Dispersal mechanisms and the tracking of biological particulates over a small island area may lead to a better understanding of dispersal mechanisms over continental areas.

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