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AEROBIOLOGY OF THE AUCKLAND REGION

IN RELATION TO

ALLERGIC ASTHMA AND RHINITIS

SYED MOHAMMED HASNAIN

A thesis submitted in partial fulfilment of the requirement for the degree of Doctor of Philosophy in the Department of Botany, University of Auckland, Auckland, New Zealand.

March 1983
TO MY PARENTS

WHO ALWAYS PRAY FOR MY HAPPINESS
The multitude of seeds produced by an Agaric or a Boletus is innumerable! It is astonishing! Yet not one in ten thousand answers the purpose of propagation. Is not the air we breathe charged with them all the declining part of the year? Do we not receive them into our lungs with every breath we draw? Whence proceed the quinsies, coughs and other complaints which prevail in autumn?

JAMES BOLTON: A History of British Ferns
(Huddersfield, 1790)

(Re-quoted from Hyde, H.A. (1972)
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ABSTRACT

Auckland, the largest city in New Zealand, with a population of approx. 700,000, is notorious for its high incidence of respiratory allergies, particularly asthma. At a conservative estimate, one in every ten persons in the region suffers from allergic asthma and/or rhinitis (hay fever). In the Auckland Hospital Board area alone, there were 58 deaths from asthma in 1979 and 57 in 1980 (an average of 5 per month). Asthma and rhinitis affect people of all ages.

To investigate the reason for the high incidence of these respiratory allergies, an aerobiological study of the qualitative and quantitative composition of the air spora was thus undertaken. To include a reasonably representative cross section of the region for air sampling three localities from near the centre of the city to the western suburban fringe were chosen along a 20 km axis encompassing commercial, residential, agricultural, horticultural and forested environments.

A Burkard 7-day recording volumetric spore trap was operated continuously at each locality, from 1 September 1979 to 31 August 1980. Counting and identification of spores and pollen grains were undertaken within 5 random microscope fields along each of 12 traverses across the spore trap tapes representing alternate hours of the day on Mondays and Tuesdays. Data were converted to concentrations (numbers m$^{-3}$ of air). Of a total of 38 spore or pollen categories recorded, 24 displayed seasonal and circadian periodicities.

The survey revealed that there was considerable contamination of the atmosphere by spores of various fungi, particularly in summer and autumn with peaks at all sites in autumn. It is of interest that the admission rate of patients with "status asthmaticus" in the two year period
January 1979 - December 1980, was also high in summer and autumn with peaks in both years in April (autumn).

Fungal spores >3 µm constituted c. 99% of the Auckland air spora in all seasons, even spring, the chief pollen season. Basidiospores were the most abundant type of the region. Amongst identified basidiospores, Ganoderma and Coprinus predominated. Basidiospores ascribable to Hypholoma, "Calvatia-Bovista", Tilletiopsis, Entoloma and Thelephora were also recorded. Ascospores of various genera were also abundant at all sites. Among them, those ascribable to the genus Leptosphaeria were most common, followed by "Hypoxylon-Xyliaria", Pleospora and Venturia. Conidia of Cladosporium were one of the principal components. Other conidia recorded, although in small numbers, belonged to the genera Polythrincium (trifolii), Epicoccum, Pithomyces (chartarum), Stemphylium, Alternaria, Periconia, Torula, Helicomyces, Helminthosporium (Drechslera), Pestalotia, Cryptostroma, Tetraploa, Arthrinium and Monilia. Conidia of "Aspergillus-Penicillium" type were the most prevalent at the city site. A comparison of the air spora at the three localities revealed major quantitative but not qualitative differences. The suburban locality emerged with higher spore concentrations than the urban and forested sites.

The relationships between some meteorological factors and the 14 most prevalent categories of the air spora were analysed. Cladosporium and Polythrincium showed a significant correlation with temperature; unidentifiable ascospores were correlated with midnight temperature, humidity and, strongly, with rainfall; Leptosphaeria correlated with rainfall and midnight temperature. Unidentifiable coloured and hyaline basidiospores as well as Ganoderma and Coprinus were positively correlated with temperature. Coloured basidiospores and Ganoderma also showed a significant "negative" correlation with wind speed.
On the basis of the aerobiological findings and a potential link with asthma admissions to hospital a total of 67 aqueous and lyophilized extracts from basidiomycetous fungi collected in the Auckland region were prepared in buffered saline, with W/V standardized concentration, for immunological studies. 'Total protein' content of the extracts were estimated. A total of 129 allergic patients both "heterogeneous group" and diagnosed, attending hospital allergy clinic, were tested by the skin prick method. Over 10% of the patients reacted positively to the crude extracts of the following fungi: *Ganoderma mastoporum*, *Ganoderma applanatum*, *Scleroderma albidum*, *Coprinus micaceus*, *Lycoperdon compactum*, *Hydnum crocidens* var. *badius*, *Xeromphalina podocarpi*, *Auricularia polytricha*, *Agaricus bisporus*, *Bovista brunea*, *Panaeolina foenisecii*, *Hypholoma assutum*, *Calvatia* sp. *Pseudohydnwn gelatinosum*, *Trametes versicolor*, *Favolaschia calocera*, *Cortinarius*, *Tyromyces*** sp. and *Hydnum crocidens**. Allergenicity to many of these genera has rarely been investigated or reported.

The findings of the investigation suggest that fungal spores in general, and basidiospores in particular, may play an important role in the high incidence of allergic asthma and rhinitis in the Auckland region.

* spores alone extracted
** hymenial tissue extracted
*** whole sporophores extracted
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CHAPTER I

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