Investigación Clínica 30(1): 13-20, 1989

PRESELECTION AREA OF A REPRESENTATIVE AEROBIOLOGICAL SAMPLING STATION OF A TROPICAL VALLEY.

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Key Words: Aerobiological sampling, station

SUMMARY

In order to search an uniform criteria for sampling aerobiological particles, three sites were selected along the valley of Caracas. The distribution of vegetation, topographical and meteorological parameters were monitored. Pollen and spores were collected at each site during 24 hr at 6 min-intervals with a Rotorod sampler. Pollen counts were similar in all sites and much less abundant than spores. *Cladosporium* **was the most abundant spore and grass pollen represented more than 50% of the pollen grains. Results showed that the three sites could be selected as suitable sampling area for airborne pollen and spores. Nevertheless, we recommend the selection of the most accesible and central site for a long-term sampling.**

INTRODUCTION

Despite considerable research activity upon atopic diseases, the prevalence of such anomalies in the tropical environment is still a controversy (16). Many reports have expressed the low frequency found in rural populations as a result of a blocking or inhibitory effect of intestinal helminthiasis (16, 18), whereas others have demonstrated an increased incidence, partial independence (9) and independent coexistance between helminthic infestation and allergic diseases (11). In addition, there is now increasing evidence that the environmental factors, their concentration and time of exposure are also responsible for the allergic reactivity in tropical climates (in preparation). Studies in Venezuela have confirmed the importance of pollen grains and spores as possible allergic precipitants of respiratory allergic diseases (2, 7).

In most programmes for sampling particles, samples are taken at only one or a few locations, as representative of wider areas. Thus, the reported variability in catch between adjacent samplers could be attributable to differences in collection efficiency

Recibido 13-10-88
Aceptado 22-05-89

among samplers of similar design, in exposure and surroundings and also in concentration. While it is usually assumed that particles which have been airborne for some time become well mixed in the lower atmosphere, this may not always be true for pollen grains and spores, since sources vary widely in size, intensity and spatial distribution, changing in response to anual and diurnal cycles and to meteorological conditions. Discrete clouds were documented in a study concerned with the transport and dispersion of airborne pollen with the use of an aircraft-mounted sampler (12).

Airborne particle levels are often non uniforms, specially when located near the surface. Therefore, choice among collection points are necessary (14). Local effects such as accesibility to the site and power lines, risk and vandalism, free horizontal air circulation, optimal elevation, productive trees and urban plantings, may be specially prominent (17). The confidence that a placed of a single sampling location sample and its representativeness are unknown.

This study was designed to document the spatial variability in airborne pollen grains and spore concentration, measured by the same sampler over a range of separation distances with a location along the valley of Caracas, as part of a multidimentional programme orientated towards the prevention and control of allergic manifestations.

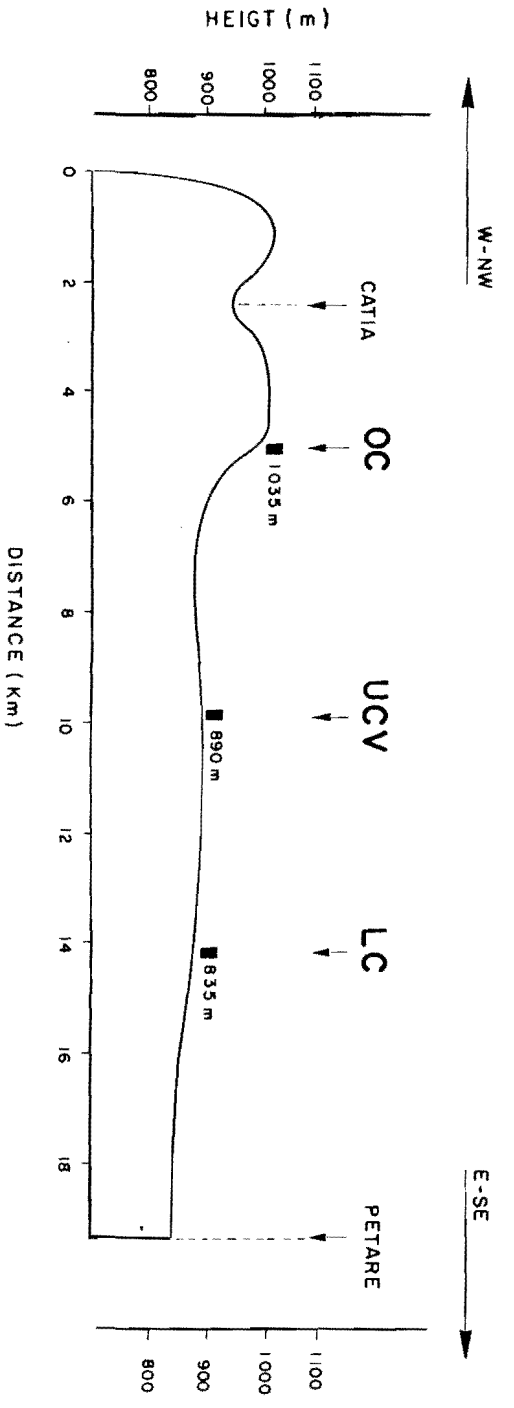
MATERIALS AND METHODS

Sampling sites and sampling methods

The study was conducted in the valley of Caracas, which is located along the WNW-ESE direction at elevations between 700 and 1050 m and separated at its northern side from the Caribbean sea by the coastal montaineous chain and at its southern side, by another ridge of lower elevations. Because of the direction of the valley and that of the wind (SE, SSE and ESE), three sites for aerobiological sampling were located along this line (Fig. 1). Each site was close to a meteorological station (class C1) which provided climatological data. The criteria for selecting the sites included good representation of the area, accessibility, restrict access of the public and source of electric power (14).

These were: La Carlota station (LC), located at La Carlota airport was at 835 m altitude; sampler was placed at the roof of the Caracas Aeroclub building, 4 m above the soil surface. UCV station was located inside the campus of the Universidad Central de Venezuela, at 20 m above the street. OC station was located at the Astronomic Observatory of Cajigal, 25 m above the soil surface. From the first sampler LC, distances were 2.5 Km and from the second UCV to the third OC, it was 2 Km.

Airborne pollen and spores were collected by mean of a Rotorod sampler (Ted Brown Associates, Los Altos Hills, Calif. USA) for intermitent sampling (10). Two


HEIGT (m)
800
900
1000
1100
W-NW
E-SE
CATIA
OC
UCV
LC
PETARE
1035 m
890 m
835 m
DISTANCE (Km)
0
2
4
6
8
10
12
14
16
18

hundred and fourty samples were collected in a period of 24 h at 6 min-intervals. Between the sampling of the first and the third station, five days had elapsed, which represented the same flowering period of the plants. Meteorological observations were recorded for each sampling period.

Particle identification

In all stations, microscopy slides were prepared in advance. Portable sampler was placed in a previously selected position or fixed sampler was uncovered. Pollen grains and spores were counted and identified by comparing with reference slides (13). Due to the diversity of the flora, it was not possible at present, to identify at the genus level in many cases. Nevertheless, the study of the families involved is in progress, to refine future airborne pollen identification.

Statistic methods

The Kendall coefficient of concordance (w) and correlation coefficients were calculated. Average for meteorological parameters were computed.

RESULTS

Table I shows the meteorological data recorded from each site over a 24 h sampling and the 1965-1980 period, respectively. It can be noted that the sampling days

TABLE I

METEOROLOGICAL DATA RECORDED FROM A 24 H SAMPLING IN THREE STATIONS AT THE VALLEY OF CARACAS

Measurements	Valley*	Station OC	UCV	LC
Rainfall (mm)	750	837	815	873
Radiation (cal/cm^2/day)	326	403	390	399
Relative Humidity (%)	80	80	78	77
Temperature (°C)	22.5	20.8	21.5	21.9
Isolation (hr/day)	6.4	7.6	6.7	7.2
Direction of wind:				
SE-ESE-SSE (%)	51	70	30	70
NW-WNW-NNW (%)	19	20	20	5
Others (%)	13	10	20	25
Hours of wind (%)	17	15	30	14.5

* Average values for the valley of Caracas between 1965 and 1980, from Alvarez et al. (1968), Fuerza Aérea Venezolana (1983), etc. Average values obtained from each site between 1965 and 1980 are presented in parenthesis.

were in general, within the average climate for each site. Small local differences among the three stations were also appreciated, specially due to rainfall.

Table II summarizes the particle distribution at each site in a 24 h sampling. Eight types of pollen grains were found to be the most frequent, whereas the most abundant

TABLE II

PARTICLE DISTRIBUTION AT THREE SAMPLING SITES IN THE VALLEY OF CARACAS

POLLEN	Station		
	LC	UCV	OC
Gramineae	88	130	108
Compositae	8	3	10
Urticales 3P	10	17	6
Mimosaceae	12	13	16
Cecropia	13	26	25
Cupressus	4	3	0
Ricinus	6	1	0
Casuarina	0	8	0
Others (< 2%)	4	14	5
TOTAL	145	215	170
FUNGI SPORES			
Cladosporium	100	185	354
Ustilago (?)	140	170	202
Ascospore 2	100	47	50
Ascospore 1	30	16	22
Ascospore 3	25	16	8
Ascospore 4	10	25	47
Lepthosphaeria 1	13	7	35
Lepthosphaeria 2	12	3	28
Basidiospora	9	12	29
Erusyphe	5	3	28
Xylariaceae	7	37	4
Ganoderma	5	40	5
HA59	21	5	29
HA23	2	50	0
HA33	12	0	35
HA57	0	0	19
Others (< 2% total)	41	34	100
TOTAL	532	650	995

All counts are expressed in m^3/24 hr.

were those of grass, which represented 60 to 63% of the total pollen grains. Curiously, the five most frequent polley types were equally recorded from all sites, although the UCV station collected a wider variety of grains compared with that of OC station, where *Cupressus*, *Ricinus* and *Casuarina* were not found. The later were only collected at the UCV station.

With regard to fungi spores, Table II shows that spores were more abundant than pollen and presented a larger number of types: *Cladosporium* was found to be the most frequent type, representing 19 to 36% of the total counted spores. Although the most frequent spore types were collected from the three stations, local differences between the three sites were rather for fungi than for pollen grains; spores were much more abundant at the OC station, where a higher rainfall occurred.

The Kendall coefficient of Concordance (w) was found to be of 0.834 for pollen grains, with 8 degrees of freedom and the probability of concordance $p > 0.95$. For fungi spores, $w=0.625$ with 16 degrees of freedom and $p > 0.98$. These results indicated that the pollen and spore counts in the three sites were not at random and could be used for sampling airborne grains.

DISCUSSION

Although there was no significant differences in a 24 h base among the three sampling sites, other considerations must be taken into account for a detailed study of airborne particles and their dispersion in the city through a minimum period of one year. The selection of only one of them is necessary at present, because of lack of equipment and people trained to analize simultaneously the sampling rods from three different sites.

The LC station, located at the airport for small aircrafts, may present air disturbance and distortion of particle distribution caused by artificial air turbulence in days with greater aircraft traffic. It also may present a greater air pollution. The OC station, on the other hand, is located at the astronomic observatory, at a higher elevation than the main urban area; this presented a smaller number of pollen types and much more fungi spores than the other two sites, located at the center of the city.

The UCV station, located in an area of high population density, presented the largest amount of pollen types and presented all the spores found at the other two stations. This station was also close to the laboratory of analysis, with ready accessibility for one year sampling. The Botanical Garden and that of the University Campus were close to the UCV station and could be considered as sources of pollen. Nevertheless, the prevalent wind SE-SSE of the valley crossed the sampling site before arriving to such gardens. In addition, the pollen from ornamental and exotic plants of the city should not be considered as a distortion of the sampling.

All these features appear to point the UCV station as the most suitable selection for a first long-term sampling area. The results from such sampling will be very useful in designing a more detailed study in which a network of stations, including the two tested here, could operate. The aerobiological sampling recorded at 3-day intervals for a whole year and its correlation with meteorological data is now in progress at the UCV station.

Acknowledgement

This research was partially supported by CONICIT of Venezuela, project S1-1373. Sincere appreciation is extended to the Herbario Nacional de Venezuela for herbarium specimens and the Center of Ecology, IVIC, for their reference slide collection. The authors acknowledge the excellent technical assistance of Alida R. de Jaffé for reviewing and typing the manuscript.

RESUMEN

Selección de una estación de muestreo aerobiológico en el valle de Caracas. *Perdomo de P. D. (Hospital de Clínicas Caracas, Av. Panteón con Av. Alameda, San Bernardino, Caracas, Venezuela), Rull V., Hernández A., Salgado-Labouriau M.* **Invest Clín** *30(1): 13-20, 1989.*– A fin de lograr un criterio uniforme en el muestreo de partículas aerobiológicas, se estudiaron tres zonas a lo largo del valle de Caracas, su distribución de vegetación, parámetros topográficos y meteorológicos. Se colectaron granos de polen y esporas durante 24 h a intervalos de 6 min, por medio de un Rotorod colocado en cada zona. El número de granos de polen colectado fué similar en las tres áreas y mucho menos abundante que el número de esporas. *Cladosporium* fué la especie más abundante y el polen de Gramíneas representó más del 50% del total de granos de polen. Los resultados muestran que los tres sitios seleccionados son igualmente representativos del valle, y que cualquiera de ellos puede ser elegido para colocar una estación de muestreo permanente. Sin embargo, recomendamos seleccionar el sitio más accesible y central para la captación aérea de partículas por períodos más largos.

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