

# AIR-BORNE FUNGI IN TULSA: I-CULTURE PLATE SURVEY

Estelle Levetin and Leon Horowitz

Faculty of Natural Sciences, University of Tulsa, Tulsa, Oklahoma, and Allergy Clinic of Tulsa, Inc., Tulsa, Oklahoma

The culture plate method was used to determine the most common air-borne fungi in Tulsa. Forty-two genera were identified. The most prevalent fungi outdoors were *Cladosporium*, *Alternaria*, *Aureobasidium*, *Epicoccum*, and *Helminthosporium*. Inside the most commonly occurring were *Cladosporium*, *Alternaria*, *Aureobasidium*, *Epicoccum* and *Penicillium*.

## INTRODUCTION

In the past forty years numerous reports have appeared in the literature on air-borne fungi (1, 3, 6, 9). These reports include surveys of city air (2, 4, 12), rural air (3), and homes (5, 7, 8, 10), as well as comparisons between geographically different cities (11) and between homes and outside environments (7, 8, 12). The only survey which included any data from Tulsa was a report by Lumpkins and Corbit (8), in which Tulsa was one of thirteen sample cities west of the Mississippi River. Their data from Tulsa resulted from a one-time exposure of plates at the homes of twelve allergy patients. Four culture plates were exposed inside each home and one plate outside each home. On their twelve outside plates only eleven genera were found. The present authors felt that the Lumpkins and Corbit study was too limited to determine the most prevalent fungi in Tulsa. This study was undertaken for that reason.

## MATERIALS AND METHODS

The culture plate technique was used. Plates for outdoor sampling contained potato dextrose agar with 0.1% streptomycin. The plates used for indoor exposure contained the above medium with the addition of 0.05% Rose Bengal.

The study was conducted over a six-month period, from January 1976 to June 1976. Plates were exposed at six locations around Tulsa. A total of 360 plates were exposed, 180 plates indoors and 180 plates outside. The exposure time was ten minutes. Unexposed plates at each location served as controls.

Following exposure the plates were sealed for transport to the laboratory where they were incubated at room temperature for five to ten days or until colonies matured. Colonies that failed to sporulate on this medium were routinely subcultured onto other laboratory media.

## RESULTS

Approximately 7600 colonies were found on these plates and a total of 42 genera were identified. The occurrence of these fungi outside and indoors is shown in Tables 1 and 2. The percentages in the tables were determined from the number of plates (out of 180) on which a given fungus occurred. The term sterile mycelia, the fifth item in Table 1 and sixth in Table 2, refers to those fungi not forming spores on the medium described here or on other media tested. The percent occurrence of sterile mycelia reported represents the total from all types of nonsporulating colonies.

## DISCUSSION

*Cladosporium* and *Alternaria* were, by far, the most prevalent fungi both indoors and outside. *Cladosporium* was found on 94.5% of the outdoor plates and 51.7% of the indoor plates; *Alternaria* was found on 86% of the outdoor plates and 51.2% of the indoor plates. This correlates with the Lumpkins and Corbit (8) study and also with studies in other areas (2, 3, 11). Further comparisons between these data and those of Lumpkin and Corbit shows little similarity. The greatest differences appear in the outdoor data. *Epicoccum*, which appeared on 57.1% of the plates in this study, only appeared on 8% of the plates in the earlier

study. Lumpkins and Corbit have no record in their outdoor data of *Aureobasidium*, *Phoma*, *Peyronellaea*, *Papularia*, or *Pithomyces*, all of which were commonly found by the present authors. Other fungi identified in this study were also absent from the earlier data. It is felt that these differences are due to the limited extent of the Lumpkins and Corbit study in Tulsa.

The present study only considered culturable fungi. Although this is the standard method for such studies, it fails to detect those fungi which cannot be cultured. Also the present study was limited to the winter and spring months. A study still in progress will be correlating culture plate data for 12 months with impingement slide data for the same period. The impingement slides will pick up rust, smut, and other basidiomycete spores as well as other fungal spores. The combined results should give a complete record of the air-borne fungi in Tulsa and reveal any seasonal variation that may exist.

At this time no attempt has been made to correlate the results with allergy patient histories; however, several fungi identified here are known to be important allergens

TABLE 1. *Fungi on plates exposed outside*

| Genus                                          | Occurrence (%) | Genus                  | Occurrence (%) |
|------------------------------------------------|----------------|------------------------|----------------|
| <i>Cladosporium</i><br>( <i>Hormodendron</i> ) | 94.5           | <i>Wardomyces</i>      | 1.7            |
| <i>Alternaria</i>                              | 86.0           | <i>Stemphylium</i>     | 1.7            |
| <i>Aureobasidium</i><br>( <i>Pullularia</i> )  | 66.7           | <i>Cephalosporium</i>  | 1.7            |
| <i>Epicoccum</i>                               | 57.4           | <i>Mucor</i>           | 1.1            |
| Sterile Mycelia                                | 32.1           | <i>Streptomyces</i>    | 1.1            |
| <i>Helminthosporium</i>                        | 25.4           | <i>Fusarium</i>        | 0.6            |
| <i>Phoma</i>                                   | 17.2           | <i>Plenodomus</i>      | 0.6            |
| <i>Penicillium</i>                             | 16.1           | <i>Thielaviopsis</i>   | 0.6            |
| <i>Peyronellaea</i>                            | 10.5           | <i>Oidium</i>          | 0.6            |
| <i>Papularia</i>                               | 9.2            | <i>Monilia</i>         | 0.6            |
| <i>Pithomyces</i>                              | 8.9            | <i>Botrytis</i>        | 0.6            |
| <i>Aspergillus</i>                             | 6.1            | <i>Selanophoma</i>     | 0.6            |
| <i>Nigrospora</i>                              | 5.0            | <i>Melanconium</i>     | 0.6            |
| <i>Rhizopus</i>                                | 4.5            | <i>Leptographium</i>   | 0.6            |
| <i>Candida</i> + other<br>white yeasts         | 3.9            | <i>Tetraploa</i>       | 0.6            |
| <i>Trichoderma</i>                             | 3.3            | <i>Geotrichium</i>     | 0.6            |
| <i>Catinula</i>                                | 3.3            | <i>Calcariosporium</i> | 0.6            |
| <i>Verticillium</i>                            | 2.2            | <i>Oidiodendron</i>    | 0.6            |
| <i>Curvularia</i>                              | 1.7            | <i>Mammaria</i>        | 0.6            |
|                                                |                | <i>Rhodotorula</i>     | 0.6            |

TABLE 2. *Fungi on plates exposed indoors*

| Genus                                          | Occurrence (%) | Genus                 | Occurrence (%) |
|------------------------------------------------|----------------|-----------------------|----------------|
| <i>Cladosporium</i><br>( <i>Hormodendron</i> ) | 51.7           | <i>Stemphylium</i>    | 1.1            |
| <i>Alternaria</i>                              | 51.2           | <i>Streptomyces</i>   | 1.1            |
| <i>Aureobasidium</i><br>( <i>Pullularia</i> )  | 32.4           | <i>Humicola</i>       | 1.1            |
| <i>Epicoccum</i>                               | 31.1           | <i>Nigrospora</i>     | 0.6            |
| <i>Penicillium</i>                             | 27.1           | <i>Rhodotorula</i>    | 0.6            |
| Sterile Mycelia                                | 15.3           | <i>Curvularia</i>     | 0.6            |
| <i>Helminthosporium</i>                        | 10.9           | <i>Rhizopus</i>       | 0.6            |
| <i>Aspergillus</i>                             | 7.9            | <i>Mucor</i>          | 0.6            |
| <i>Papularia</i>                               | 7.1            | <i>Cephalosporium</i> | 0.6            |
| <i>Phoma</i>                                   | 5.0            | <i>Botrytis</i>       | 0.6            |
| <i>Pithomyces</i>                              | 2.2            | <i>Peyronelia</i>     | 0.6            |
| <i>Oidiodendron</i>                            | 2.2            | <i>Verticillium</i>   | 0.6            |
| <i>Candida</i> + other<br>white yeasts         | 2.2            | <i>Chaetomella</i>    | 0.6            |
| <i>Geotrichium</i>                             | 1.7            | <i>Trichaeium</i>     | 0.6            |
| <i>Monilia</i>                                 | 1.1            | <i>Trichoderma</i>    | 0.6            |
|                                                |                | <i>Peyronellaea</i>   | 0.6            |

(1, 3). It is hoped that these data can be used by allergists in the state to help diagnose patient problems.

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