12.5 POLLEN FORECASTING: THE MELDING OF AEROBIOLOGY, PLANT PHENOLOGY, AND METEOROLOGY

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1. INTRODUCTION

Juniperus ashei (JA) pollen is responsible for a severe form of allergic rhinitis known as "cedar fever" in the Texas-Oklahoma area. Pollination of JA occurs during December and January and long distance transport of JA pollen has been well documented in previous studies (Levetin and Buck, 1986; Levetin, 1998; Rogers and Levetin, 1998; Van de Water and Levetin, 2001). Starting in Dec 1998 pollen forecasting has been undertaken to warn downwind populations of the potential threat of high pollen concentrations in the atmosphere.

2. MATERIALS AND METHODS

Forecasting requires a thorough knowledge of the ecology, phenology, and aerobiology of JA along with knowledge of local and regional weather. The daily forecast includes both a release forecast and a downwind forecast.

The release forecast has been based on meteorological conditions and the phenology of the plants. Once pollen cones are mature, the meteorological conditions necessary for pollen release include air temperatures above 45^{o}F and relative humidity below 50%. Sunshine and the absence of rainfall during the previous 24 hours also enhance pollen release; however, extended periods without rain resulted in reduced pollen production. Forecasts are posted on the internet daily during the pollination season from the University of Tulsa at http://pollen.utulsa.edu. Over the past four seasons a total of 628 forecasts were issued.

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The downwind forecast is based on trajectories generated using the HY-SPLIT model from NOAA Air Resources Laboratory (available on line at http://www.arl.noaa.gov/ready/hysplit4.html) and on meteorological conditions along the path.

Assessment of the release forecasts has been based on air sampling data from our Burkard spore traps at two sites within the JA population on the Edwards Plateau of central Texas, which operated during the winters of 1998-1999, 1999-2000, and 2000-2001. Air sampling data from three samplers in the Tulsa area were used to test the accuracy of the forecast trajectories and the predicted threat to downwind communities

3. RESULTS

Analysis of the pollen release forecasts from the Texas sites show a strong relationship between recorded pollen levels and predicted conditions for release (Fig 1). For the three seasons mean airborne pollen concentration for all days when conditions were described as unfavorable for

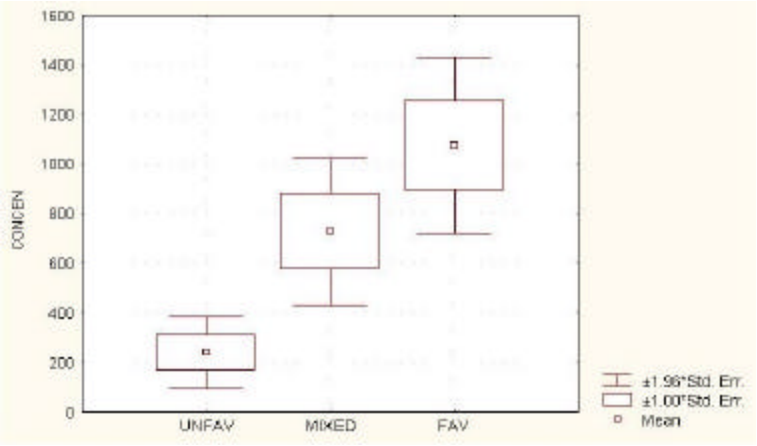

Figure 1. Mean airborne *Juniperus ashei* pollen concentrations (pollen grains/m^3) for all days during the 98/99, 99/00, and 00/01 pollen seasons group by forecast conditions for pollen release.

release was 239 pollen grains/m^3; for all days described as mixed conditions for release the mean was 727 pollen grains/m^3; and for all days with favorable conditions for release the mean was 1075 pollen grains/m^3. During the past four winters, JA pollen was recorded from the Tulsa atmosphere (Fig. 2, Table 1). Analysis of the 98/99, 99/00, 00/01, and 01/02 seasons revealed only two occurrences of "high" or "very high" pollen concentrations in Tulsa that were not directly linked to a wind trajectory from a source area.

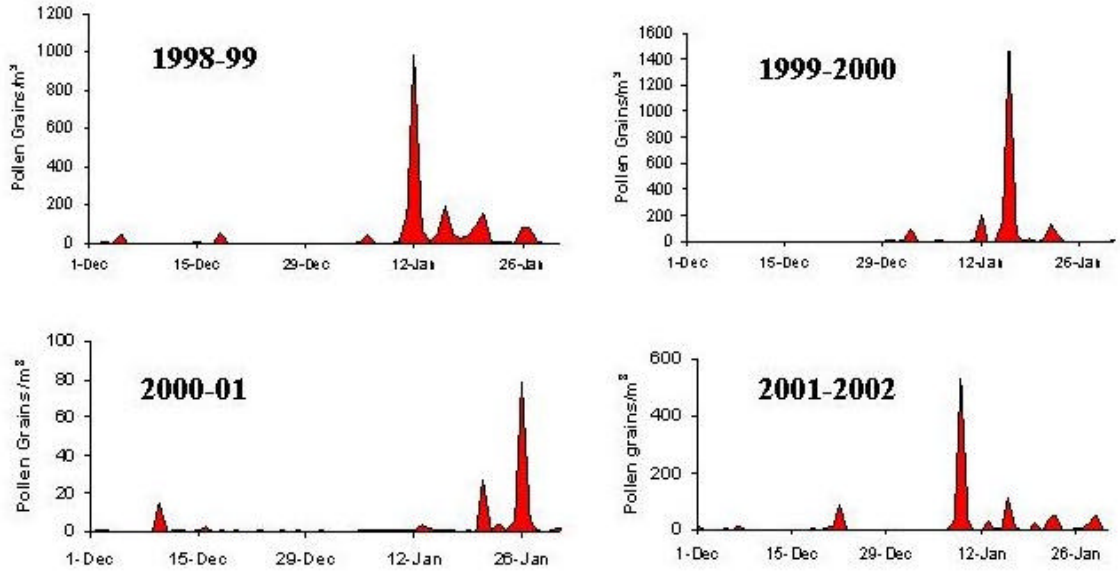

Figure 2. Seasonal incursions of *Juniperus ashei* pollen into the Tulsa atmosphere. Note the different concentration scales for each graph.

Table 1. Analysis of the December/January Pollen in the Tulsa Atmosphere

	Days Pollen Present	Days with Mod Conc	Days with High Conc	Trajectories Crossing Tulsa
98/99	49	10	5	40
99/00	44	4	5	20
00/01	37	3	0	20
01/02	43	12	2	51

Results indicate that our pollen forecasting was successful in predicting the influx of JA pollen concentrations dispersed over long distances. Aerobiology, plant phenology, and meteorology can be successfully used to warn individuals about the exposure risk due to high atmospheric pollen levels.

Acknowledgments

This research was made possible, in part, by a National Science Foundation - Experimental Partnership to Stimulate Competitive Research grant (Project Number EPS9550478) which provided funds to enhance the Oklahoma Mesonet.

5. REFERENCES

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