Investigating the Composition and Physical Properties of Sporopollenin

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Objectives

- Build spectral library for different samples of pollen using Fourier transform infrared photoacoustic spectroscopy (FTIR-PAS) and attenuated total reflectance Fourier transform infrared (ATR-FTIR) Spectroscopy
- Determine how pollen species differ in their spectra
- Investigate the structure of sporopollenin

Previous Work

- Using FT-IR-PAS, approximately 100 measurements were taken from samples comprising five families and ten species.[1]
- Principal component analysis and cluster analysis were used to examine the similarities and differences in the spectra of differing species.
- The library correctly identified the pollen samples 100% of the time at the family level but only 99% at the species level.

References

1. Cassidy, J., Thesis. 2015; pp 1-23.

Results

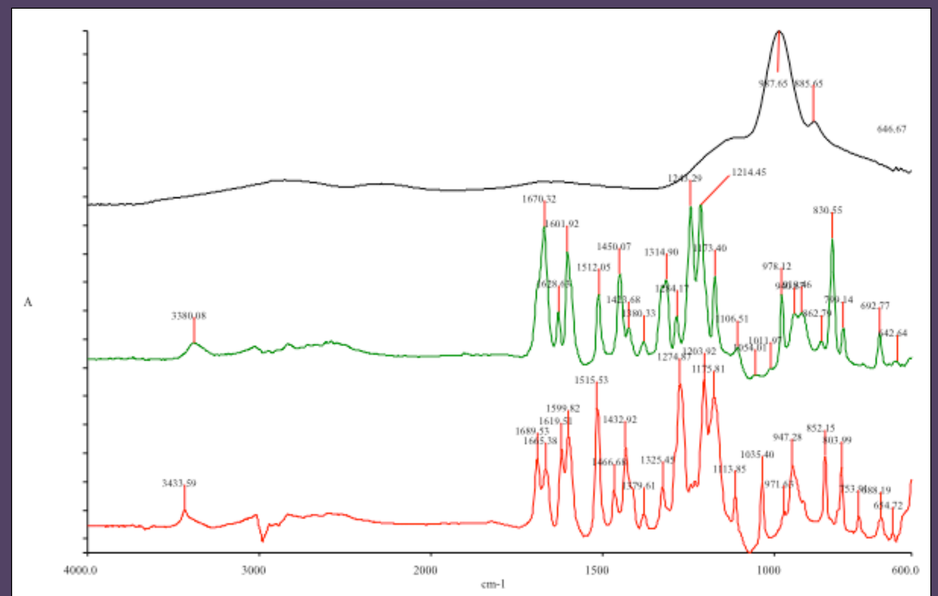

Figure 1: ATR-FTIR for untreated, BHS, and AHS Ragweed

	Significant peaks in each region		
	4000 cm^{-1} – 2000 cm^{-1}	2000 cm^{-1} – 1000 cm^{-1}	1000 cm^{-1} – 700 cm^{-1}
Ragweed	3320.37 cm^{-1} 2924.75 cm^{-1} 2854.27 cm^{-1} 2360.47 cm^{-1} 2329.07 cm^{-1}	1734.99 cm^{-1} 1667.33 cm^{-1} 1515.97 cm^{-1} 1438.94 cm^{-1} 1377.02 cm^{-1} 1282.80 cm^{-1} 1241.83 cm^{-1} 1169.96 cm^{-1} 1098.99 cm^{-1}	993.77 cm^{-1} 834.11 cm^{-1} 649.61 cm^{-1}
BHS Ragweed	2924.63 cm^{-1} 2854.00 cm^{-1} 2356.02 cm^{-1} 2334.12 cm^{-1}	1660.95 cm^{-1} 1561.07 cm^{-1} 1440.33 cm^{-1} 1053.06 cm^{-1}	880.19 cm^{-1} 865.02 cm^{-1} 659.69 cm^{-1}
AHS Ragweed			987.65 cm^{-1} 885.65 cm^{-1} 646.67 cm^{-1}

Table 1: Significant Peaks in Spectra for untreated, BHS, and AHS Ragweed

Experimental

- Pollen grains were washed in ethanol then put in a 6% v/v solution of NaOH for six hours at 80°C. The solution was filtered.
- The remaining pollen grains were placed a 6% v/v solution of NaOH for six hours at 80°C for the second time. The solution was filtered and then placed in an overnight oven to dry at approximately 60°C.
- The dried Base Hydrolyzed Sporopollenin (BHS) was suspended in 85% phosphoric acid at 80°C for a week then filtered.
- The Acid Hydrolyzed Sporopollenin (AHS) was then washed with water, ethanol, 2M HCl, and 2 M NaOH.
- Immediately after the completion of the BHS and AHS steps, spectra were taken of the sporopollenins by FTIR-PAS and ATR-FTIR.

Discussion

- Observations were consistent with previous study of sporopollenin extracted from ragweed
- Peaks represent the lost of nucleic acids, proteins, and amino acids that existed within the inner layer as the pollens were exposed to acid/base chemistry
- Peaks were not yet specifically identified because of sporopollenin's complex structure