Weather Conditions and Fungal Presence in Central Park

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INTRODUCTION

Fungi are a diverse group of eukaryotes that serve as important ecological decomposers and symbionts (Watkinson 2016). Partly because of fungi's high surface area-to-volume ratio, fungal growth tends to spike in environments with high moisture and moderate temperatures, and higher humidity levels tend to be especially fruitful for soil fungi (Talley et al. 2002). Studies of both airborne fungal spores and soil-based fungi have similarly shown ties between bioclimatic area and fungal abundance (Abrego et al. 2024). Our study examines the relationship between fungal presence in Central Park vs. temperature and precipitation levels over the course of five years (2020-2024), with a focus on summertime months.

RESEARCH QUESTION

Is there a correlation between the number of fungi observations in Central Park and summertime temperature or precipitation levels?

METHODS

Our data was taken primarily from iNaturalist, a public website that helps people identify species and upload observations. We filtered all research-grade fungi observations logged in Central Park during the months of June, July, and August every year from 2020 to 2024. Research-grade refers to observations confirmed by more than one iNaturalist user, increasing reliability of the data collected. For temperature and precipitation data, we referred to the online National Oceanic and Atmospheric Administration weather database, filtering monthly summarized data by date (June, July, and August from 2020-2024) and location (Figure 3). For the purposes of our study, temperature measurements for each month are the averages of average daily temperatures, and precipitation refers to monthly total precipitation as reported in the NOAA database. To gauge whether or not a significant correlation existed between temperature and fungi population or precipitation and fungi abundance, we conducted a bivariate correlation analysis using the Pearson correlation coefficient formula for an r-value. Then, we compared our calculated r-value to a table of critical values (Oja 2021) to evaluate the likelihood of correlational significance at different p-values.

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RESULTS

Correlation Coefficient
R = 0.42970

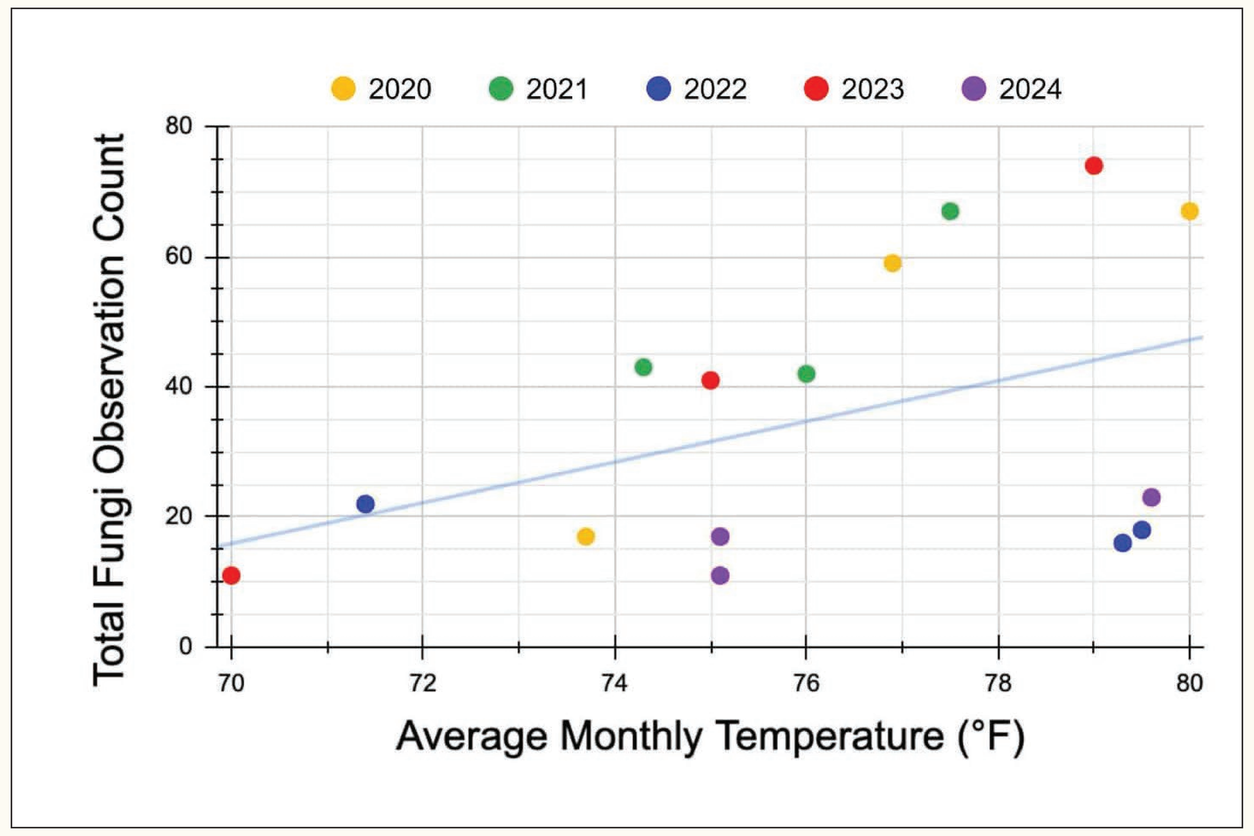

Figure 1. Average monthly temperature in fahrenheit (from June to August) compared with the total fungi observations recorded in Central Park (from iNaturalist data) from 2020 to 2024 .

Correlation Coefficient
R = 0.49575

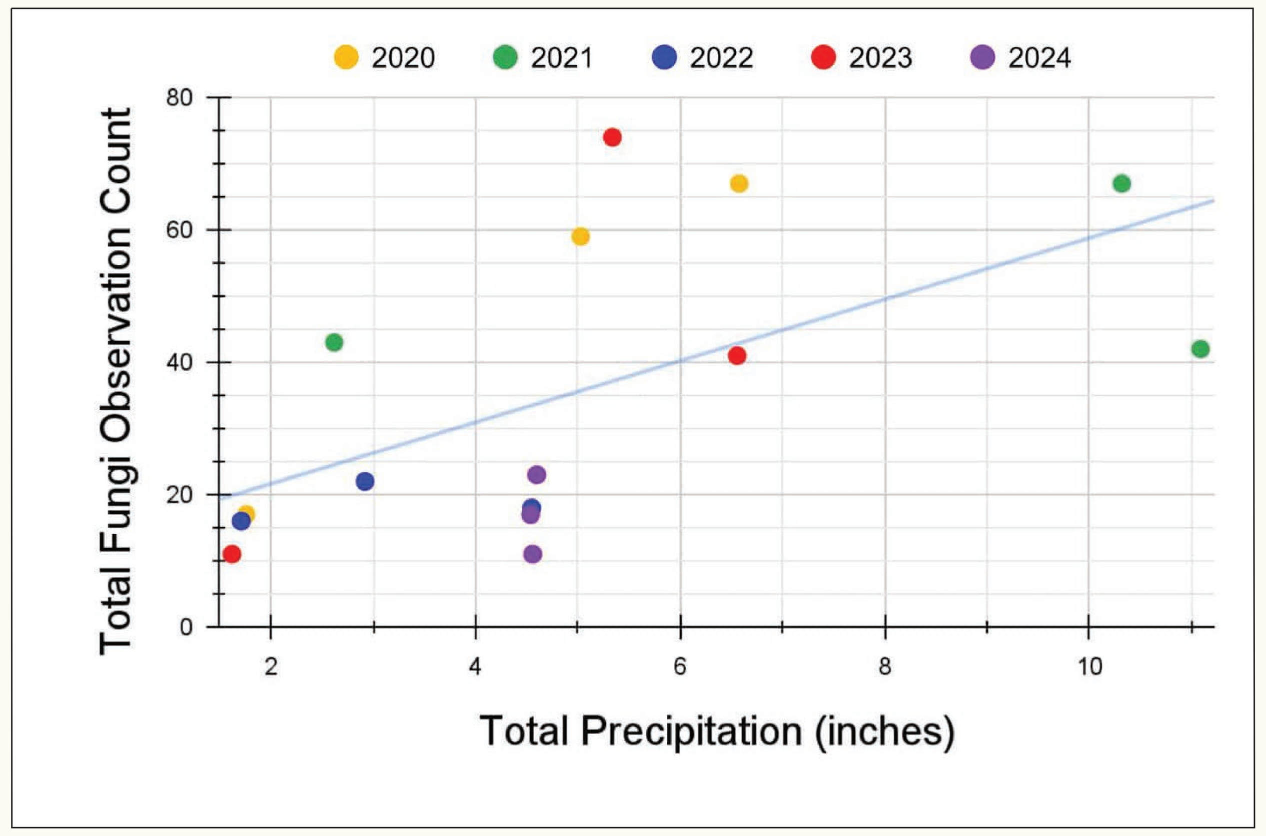

Figure 2. Total precipitation in inches (from June–August) compared with the total fungi observations recorded in Central Park (from iNaturalist data) from 2020 to 2024.

Figure 3. Map of Central Park and location of NOAA's weather

Rank	Common Name/Species Name	Total Fungi Count Observed
1	Plantain Mildew *(Golovinomyces sordidus)*	46
2	Black-staining Polypore *(Meripilus sumstinei)*	28
3	Candleflame Lichen *(Candelaria concolor)*	27
4	Berkeley's Polypore *(Bondarzewia berkeleyi)*	20
5	Spindletree Powdery Mildew *(Erysiphe euonymicola)*	16
6	White-pored Chicken of the Woods *(Laetiporus cincinnatus)*	13
7	Oak Bracket *(Pseudoinonotus dryadeus)*	13
8	Golden Reishi *(Ganoderma curtisii)*	10
9	Powdery mildew of lilac *(Erysiphe syringae)*	10
10	Turkey-Tail *(Trametes versicolor)*	9

Figure 4. Top fungi species ranked by total observation counts gathered from iNaturalist from June–August across the years 2020–2024.

Photo by Susan J. Hewitt

Photo by Michael Nerrie

Photo by Samuel Brinker

Photo by Sigrid Jakob

Photo by Susan J. Hewitt

Photo by Nate Swick

Figures 5–10. iNaturalist observer photographs of the six most frequently recorded fungi species from June to August, 2020–2024 (corresponding to Figure 4).

CONCLUSION

We assumed that a p-value less than 0.05, i.e. 95% confidence that the results did not result from chance, suggests a significant correlation. Based on the critical value table, with 15 data points (df =13), the critical r-value is 0.514 at $p = 0.05$ and 0.441 at $p = 0.1$. Our results show that when $r = 0.4297$, the p-value is between 0.05 and 0.1 ($0.05 < p < 0.1$), and when $r = 0.49575$, the p-value is greater than 0.1 ($p > 0.1$). Using a statistical calculator, we confirmed that for $r = 0.4957$, the p-value is 0.085, and when $r = 0.4297$, the p-value is 0.143. Given that both p-values exceed 0.05, we retain our null hypothesis that during the summer months (June to August), there is no significant correlation between either number of fungi observations and temperature or number of fungi and precipitation levels.

DISCUSSION

Despite there being no significant correlation between temperature or precipitation and the number of fungi observations in Central Park, there are some caveats to our research: for one, a focus on only summertime data may have limited the scope of variety in our weather data because of the potentially-biased assumption that more amenable weather would lead to more observers and thus larger sample sizes. Second, although we made sure to only collect research-grade iNaturalist observations, the spikes in observations during some months (e.g. July 2023) and substantive dips during others (e.g. June 2023) may have skewed our graphs and subsequent correlation tests because of the likelihood that some months had more active observers than other, thus not being an accurate reflection of the actual fungi population in Central Park. Not all of the fungi present would have been logged into iNaturalist, and we recognize that the data found constitute only a small sample. Also, as shown by Figures 4 and 5-10, the most common fungi observed are classified as plant pathogens, meaning that they thrive near trees or plants. Their vibrant colors and sizes could make them more likely to be recorded and found, thereby also affecting the number of fungi observations.

FUTURE WORK

Further research might involve making observations with greater seasonal variety over a longer time period, along with consideration of species number and diversity. Instead of relying solely on iNaturalist data, which may not be as useful for wintertime data collection because of scarcity of observers, an alternative would be to conduct these observations first hand. This will enable us to understand how distinct fungal species are affected by fluctuating or adverse weather conditions and will also provide data that are less skewed compared to the data used in this study. Another addition would be an analysis of fungal species variety in Central Park during different seasons, as this may help us conclude whether various fungal species are differently impacted by weather changes. Additionally, a targeted study of urban fungal abundance and species diversity in different NYC parks and neighborhoods will be useful in assessing the validity of our findings relative to other green spaces in the city.