Annual Diversity in Pollen Aeroflora with Emphasize on Seasonal Variations in Amravati Region

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Abstract

Without a doubt, climate warming poses a threat to people who suffer from allergy disorders. The consequences on living things, like as plants and fungus, have already been felt, and by the end of the century, more repercussions are expected, according to current projections. Additionally, the direct interactions between pollen and urban air pollution may have contributed to these alterations. In this context, to determine the aerial concentration and seasonality of pollen and fungal spores, aerobiological research had been conducted and a few sites of Amravati Region were sampled in the mid summer, winter and autumn season for the assessment of aeroflora. The bioaerosols were sampled from MIDC area, Uttamsara village, Ram Mandir and Modi Hospital from Badnera. All the sites showed variations in the total contents of the bioparticles. Also, it was noteworthy that the sampling explored the seasonal variations in the aeroflora. Some of the prominent pollen types were *Parthenium hysterophorus*, *Gossypium herbaceum*, *Brassica* compestris, *Catharanthus roseus*, *Tegetes petula*, *Cicer arietinum*, *Triticum* aestivum, *Allamanda cathartica*, *Galphimia gracilis*, *Tridax procumbens*, *Chrysanthamum* sp., *Moringa oleifera* and *Barleria prionitis*.

Keywords: Pollen, Aeroflora, Allergy, Seasons, Bioaerosols.

1. Introduction

Aerosols are the name for airborne particles. Algae, fungi, bacteria, viruses, pollen, and other bioaerosols are examples of bioaerosols that make up aerospora. Pollen and fungal spores make up the majority of biological environmental contaminants [1]. Aerospora range in size from 0.02 m to 100 m, and in plant pieces, they can reach lengths of several centimetres. The pollen and fungal quantities in the air are the main subjects of the aerobiological observations. Some scientific fields, including phenology, climatology, ecology, agriculture, forensics, and allergology, greatly benefit from the findings of this approach [2]. To prevent the addition of allergies or plant infections, care must be taken while planting new trees in woods, urban areas, parks, etc. The spectrum of airborne pollen also provides information about a location's vegetation.

By 2050, India is expected to overtake China as the world's most populated country. This formerly rural culture is currently experiencing extraordinary rates of industrialization and urban expansion [3]. As the fastest expanding metropolis in the eastern region of India with a population of more than 13 million [4], Kolkata (formerly Calcutta) has experienced significant changes in the vegetation and meteorological conditions over time. The aeroallergens that cause sensitization and the formation of particular antibodies may vary from location to region and change in response to climatic and geographic factors including temperature, humidity, and rainfall. It has been established that some people get hay fever and seasonal asthma after being exposed to the pollen of specific plants [5]. Because of its significance in treating patients with allergy illnesses brought on by biopollutants, the study of airborne pollen has become increasingly important in recent years. In light of this, the current study was created to sample the differences in the aeroflora of this area in order to understand the seasonal and annual variations.

2. Materials and Methods
2.1 Method

By employing a Tilak air sampler and the volumetric approach, the aerobiological sampling was carried out. It is a Burkard sampler modification made specifically for Indian weather conditions [6]. An

exhaust fan is installed on the top position of the sampler in place of a vacuum pump. The device is powered by an electric source (AC-220 V). The electronic clock that is built within the instrument syncs with the drum. 5 litres of air per minute are sucked through the projecting tube's mouth and impact on the translucent cello tape, which is 1.5 cm wide and fixed to the slowly spinning drum. In 8 days, the drum makes one full circle. Vaseline was applied to the tape. In the glycerin jelly, cello tape mounting was completed. The tape was divided into numerous portions, each of which was put on a different slide before scanning. For the purpose of counting aerospora, trinocular fluorescent microscopy was used to see the slides.

2.2 Data Collection

The Amravati region was surveyed and four significant sampling sites were selected. The significance of the site was determined by the location importance in social life of the people, frequent visitors and the population of the area (Figure 1). The data were collected from 2020 to 2022 in midsummer, winter and autumn season.

2.3 Identification

The morphological details of pollen grains were observed under digital microscope 'Labomed Model No. IVU 3100'. Pollen grains were identified with the help of available literature [7, 8].

3. Results and Discussion

The data was collected from all four sampling sites from the selected sampling site during 2020-2022; MIDC area (a), Uttamsara village (b), Ram Mandir (c) and Modi Hospital (d) from Badnera (Figure 1). Microscopic observation of aerospora showed pollen grains as dominant aerosols at all sampled locations.

Figure 1 Location of the Sampling Sites within the Study Area.
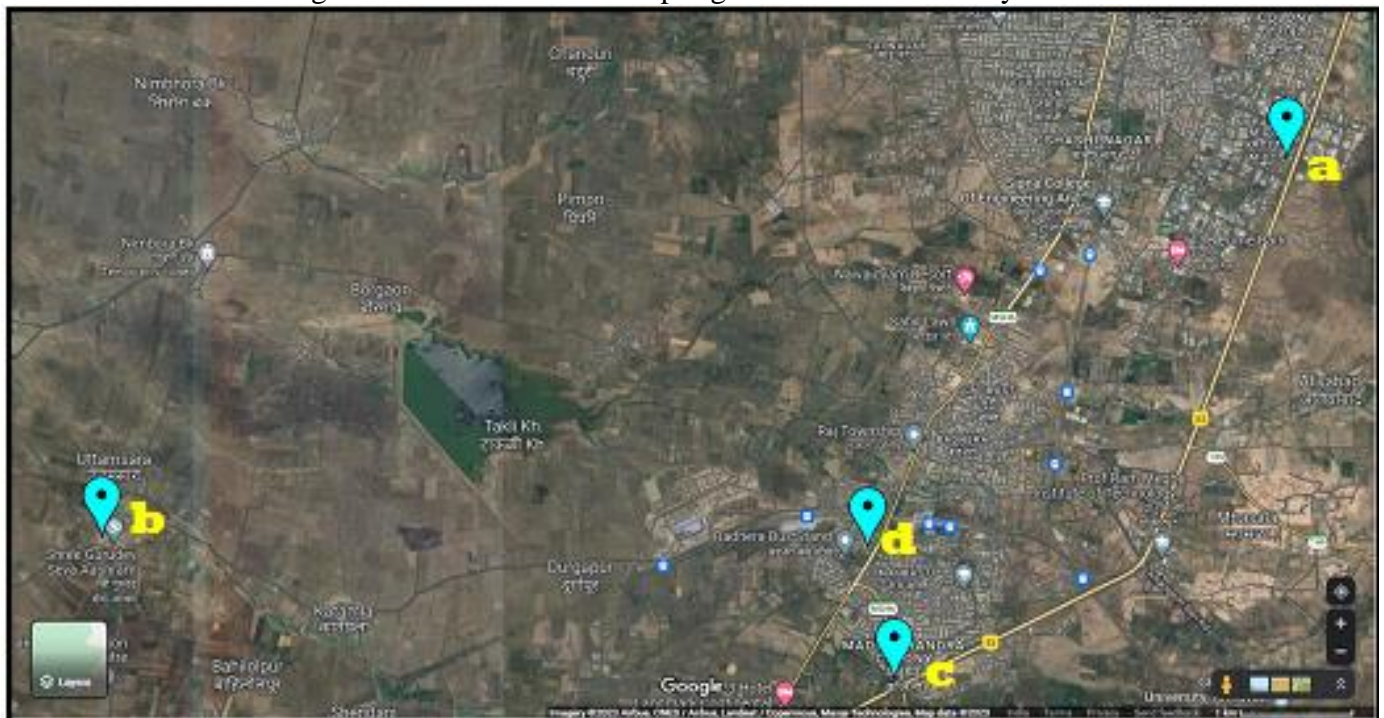
During the investigation variations were observed in the sampled pollen types at all locations. A very few pollen types were common at studied four sampling sites. The dominant pollen types observed with respect to the sampling period and sampling locations during the study are given in the Table 1.
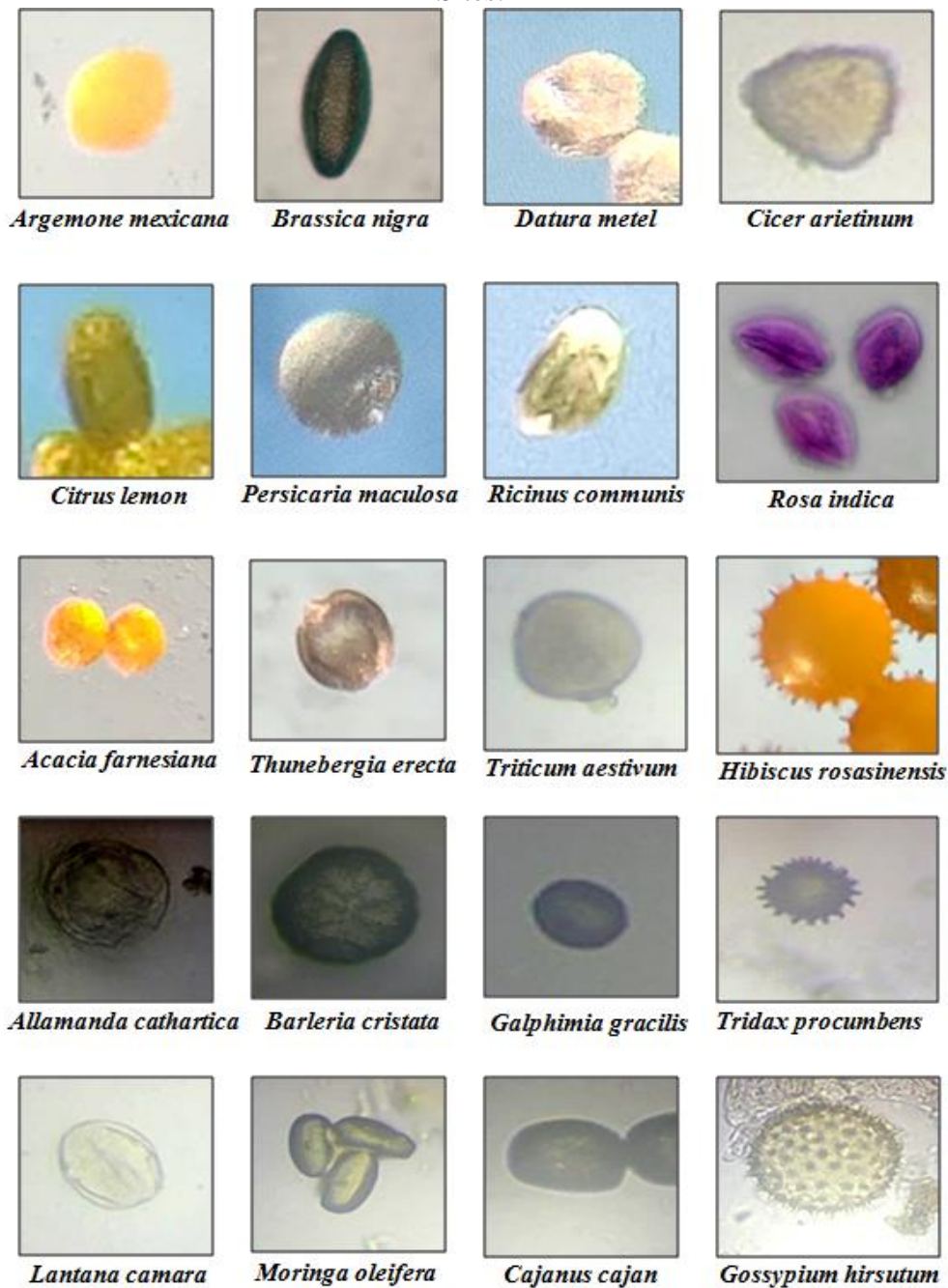
Table 1 The Various Types of Dominant Pollen Grains Observed During the Study.

Sr. No.	Scientific name	Family
Dominant Pollen Types in 2020		
1	*Lantana camara* L.	Verbenaceae
2	*Barleria cristata* L.	Acanthaceae
3	*Galphimia gracilis* Bartl.	Malpighiaceae
4	*Moringa oleifera* Lam.	Moringaceae
5	*Gossypium hirsutum* L.	Malvaceae
Dominant Pollen Types in 2021		
6	*Parthenium hysterophorus* Adans.	Asteraceae
7	*Plumbago indica* L.	Plumbaginaceae
8	*Cajanus cajan* (L.) Millsp.	Fabaceae
9	*Acacia farnesiana* (L.) Willd.	Fabaceae
10	Unidentified Grass	Poaceae
Dominant Pollen Types in 2022		
11	*Triticum aestivum* L.	Poaceae
12	*Persicaria maculosa* Gray	Polygonaceae
13	*Acacia farnesiana* (L.) Willd.	Fabaceae
14	*Thunbergia erecta* T. Anderson	Acanthaceae
15	*Parthenium hysterophorus* Adans.	Asteraceae
Dominant Pollen Types at Ram Mandir Area		
16	*Allamanda cathartica* Schrad.	Apocynaceae
17	*Barleria cristata* L.	Acanthaceae
18	*Tridax procumbens* L.	Asteraceae
19	*Datura metel* L.	Solanaceae
20	*Tagetes erecta* L.	Asteraceae
Dominant Pollen Types at Modi Hospital Area		
21	*Parthenium hysterophorus* Adans.	Asteraceae
22	*Gossypium hirsutum* L.	Malvaceae
23	*Cajanus cajan* (L.) Millsp.	Fabaceae
24	*Acacia farnesiana* (L.) Willd.	Fabaceae
25	*Cicer arietinum* L.	Fabaceae
Dominant Pollen Types at M.I.D.C Area		
26	*Gossypium hirsutum* L.	Malvaceae
27	*Cajanus cajan* (L.) Millsp.	Fabaceae
28	*Acacia farnesiana* (L.) Willd.	Fabaceae
29	*Cicer arietinum* L.	Fabaceae
30	*Allamanda cathartica* Schrad.	Apocynaceae
Dominant Pollen Types at Uttamsara Area		
31	*Plumeria obtusa* L.	Apocynaceae
32	*Brassica nigra* W.D.J.Koch	Brassicaceae
33	*Gossypium hirsutum* L.	Malvaceae
34	*Parthenium hysterophorus* Adans.	Asteraceae

35	*Lantana camara* L.	Verbenaceae

In the present study, the sampled pollen types belongs to family Verbenaceae, Acanthaceae, Malpighiaceae, Moringaceae, Malvaceae, Asteraceae, Plumbaginaceae, Fabaceae, Poaceae, Polygonaceae, Apocynaceae, Solanaceae and Brassicaceae (Table 1, Figure 2). In 2020 sampling period, dominant pollen types that were observed are *Lantana camara*, *Barleria cristata*, *Galphimia*, *Moringa oleifera* and *Gossypium hirsutum*. In 2021, the main pollen types were *Parthenium hysterophorus*, *Plumbago indica*, *Cajanus cajan*, *Acacia farnesiana* and Unidentified Grass. Whereas in 2022, *Triticum aestivum*, *Persicaria maculosa*, *Acacia farnesiana*, *Thunbergia erecta* and *Parthenium hysterophorus*. If the variations are to be observed by the sampling sites during the study period from 2020-2022, then the chief pollen types at Ram Mandir area were *Allamanda cathartica*, *Barleria cristata*, *Tridax procumbens*, *Datura metel* and *Tagetes erecta*. While the dominant pollen types from Modi Hospital area was *Parthenium hysterophorus*, *Gossypium hirsutum*, *Cajanus cajan*, *Acacia farnesiana* and *Cicer arietinum*. Whereas, *Gossypium hirsutum*, *Cajanus cajan*, *Acacia farnesiana*, *Cicer arietinum* and *Allamanda cathartica* were dominant in M.I.D.C. area. Moreover, *Plumeria obtuse*, *Brassica nigra*, *Gossypium hirsutum*, *Parthenium hysterophorus* and *Lantana camara* were the main components of aerospora from Uttamsara area.

Figure 2The Variations in Sampled Pollen Types During the Study Period from Four Different Sampling Sites.

Argemone mexicana — *Brassica nigra* — *Datura metel* — *Cicer arietinum*

Citrus lemon — *Persicaria maculosa* — *Ricinus communis* — *Rosa indica*

Acacia farnesiana — *Thunebergia erecta* — *Triticum aestivum* — *Hibiscus rosasinensis*

Allamanda cathartica — *Barleria cristata* — *Galphimia gracilis* — *Tridax procumbens*

Lantana camara — *Moringa oleifera* — *Cajanus cajan* — *Gossypium hirsutum*

Similar to our observations, Bangalore's Parthenium sp. content was found to be lower than in prior investigations, and this was attributed to the city's fast development and the success of various eradication operations [9, 10]. In the current report, it was discovered that some pollen grains have allergic characteristics. The pollen grains, which differ from location to place, are a major contributor to allergic diseases [11]. The pollen grains that were seen may therefore be allergic. The amount of pollen grains hanging in the atmosphere, however, might be a significant factor in what triggers an allergic reaction. Ipomea fistula, Ricinus communis, and other plants from central India, such as Azadirachta, Lantana, and others, were shown to be allergic in Calcutta and to be sensitive in 18.2% of patients [12]. The release and dispersion of pollen grains may be impacted by weather factors including temperature, humidity, wind speed, etc. This causes the seasonal change in the various pollen grain types. Similar to the current findings, pollen counts vary from location to location. For example, aerial surveys conducted at Bikaner (Rajasthan) in March revealed the highest concentration of amaranth-chenopodium. Small insects, insect wings, and

trash are examples of other sorts. Due to their hyaline appearance and poorly defined morphological characteristics, some pollen grains could not be identified.

4. Conclusion

The four sampling sites of the Amravati region's airborne pollen kinds are revealed by the aeropalynological inquiry. While some pollen types were unique to certain places, others were common to many. All sites' pollen samples were predominately of the Fabaceae family. From this study, it can be inferred that biological factors like vegetation and atmospheric factors like temperature, wind speed, and humidity also have an impact on the distribution, abundance, and existence of palynomorph in the atmosphere.

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