



BIOLOGICAL AIRBORNE PARTICLES IN KIRSEHIR ATMOSPHERE EXCEPT FOR POLLEN AND FUNGAL SPORES

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ABSTRACT. Aerobiology is a branch of biology that examines biological particles found both in the outdoor and indoor air. People's daily lives are influenced by these airborne biological particles in the air. Many people in society show an allergic reaction to these allergic airborne particles. A significant portion of the world's population reacts with airborne particles inhaled in various forms. The severity of these reactions varies with the degree of exposure to these particles over time and the concentration of the inhaled particles. In this study, for two years it has been investigated that biological particles (fungal hyphal fragments, pteridophyte spores, plant hairs, insect, insect extremities, moth scales, diatom etc. except for pollen and fungal spores) of Kirsehir atmosphere by using Burkard 7-day air sampler. In total, 4674 particles in 2015, and 5262 biological particles in 2016, have been counted.

1. INTRODUCTION

The air we breathe contains microscopic biological particles such as viruses, bacteria, fungal spores, fragments and pollen, some of them with relevant clinical importance. It is important to know when the biological particles such as pollen, fungal spores and the other biological particles are released into the atmosphere, their density in the atmosphere, and their relationship with the climate in terms of Aerobiology knowledge. Numerous studies have been carried out on pollen and fungal spores in the atmosphere and their allergic potentials [1-6]. Algae, protozoa, microfungi hyphae, bryophytes and fern fragments and insect and insect fragments that are present in humans, even if not as much as pollen and spores, cause important allergic reactions [7-10]. In this study, we have tried to identify other types of biological particles (fungal hyphal fragments, pteridophyte spores, plant hairs, insect, insect extremities, moth scales, diatom etc.) observed in Kirsehir atmosphere, except for pollen and fungal spores.

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2. MATERIALS AND METHODS

2.1 Study area

Kirsehir province is in the Middle Kızılırmak section of the Central Anatolia Region. Nevşehir, Aksaray, Kırıkkale, Yozgat and Ankara, the width of the territory of the province is 8% in the territory of the country and 2.9% of the territories in the Central Anatolia Region. It is located at an altitude of 985 meters from the sea.

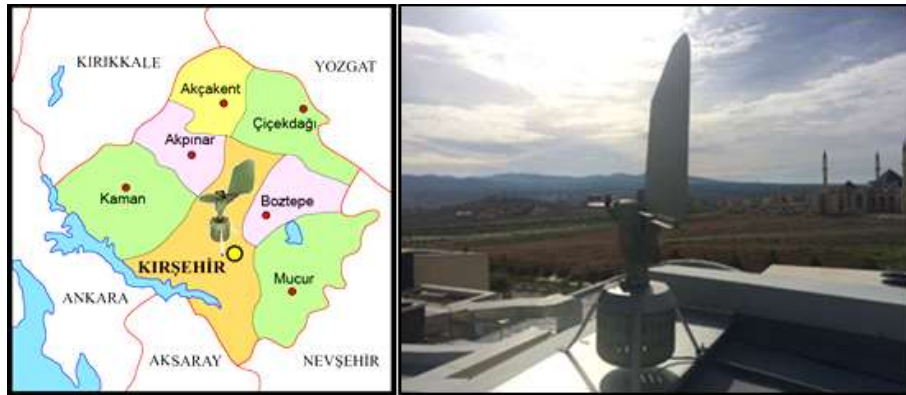


FIGURE 1. Location map of Kirsehir and Burkard volumetric 7-day air sampler

2.2 Collection of airborne particles

Biological particles were collected using a 7-day recording volumetric Burkard spore trap during 2015-2016. The trap was placed on the roof of the Kirsehir Ahi Evran University, Faculty of Arts and Sciences building in Kirsehir at a height of 12 m above ground level (Figure 1). Atmospheric sampling and analysis followed the method described by the Spanish Aerobiological Network (REA) [11]. Particles counts were converted into daily average concentrations.

2.3 Meteorological data

Monthly meteorological data (temperature, relative humidity, precipitation and wind speed) were obtained from the Turkish State Meteorological Service located at Ankara (Figure 2).



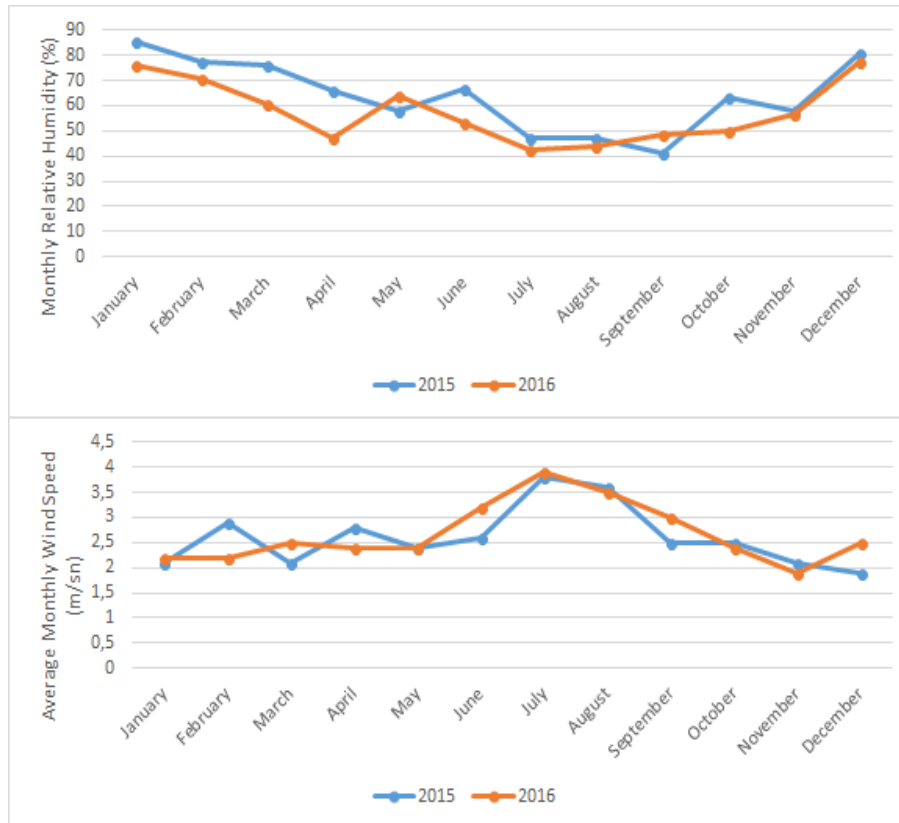
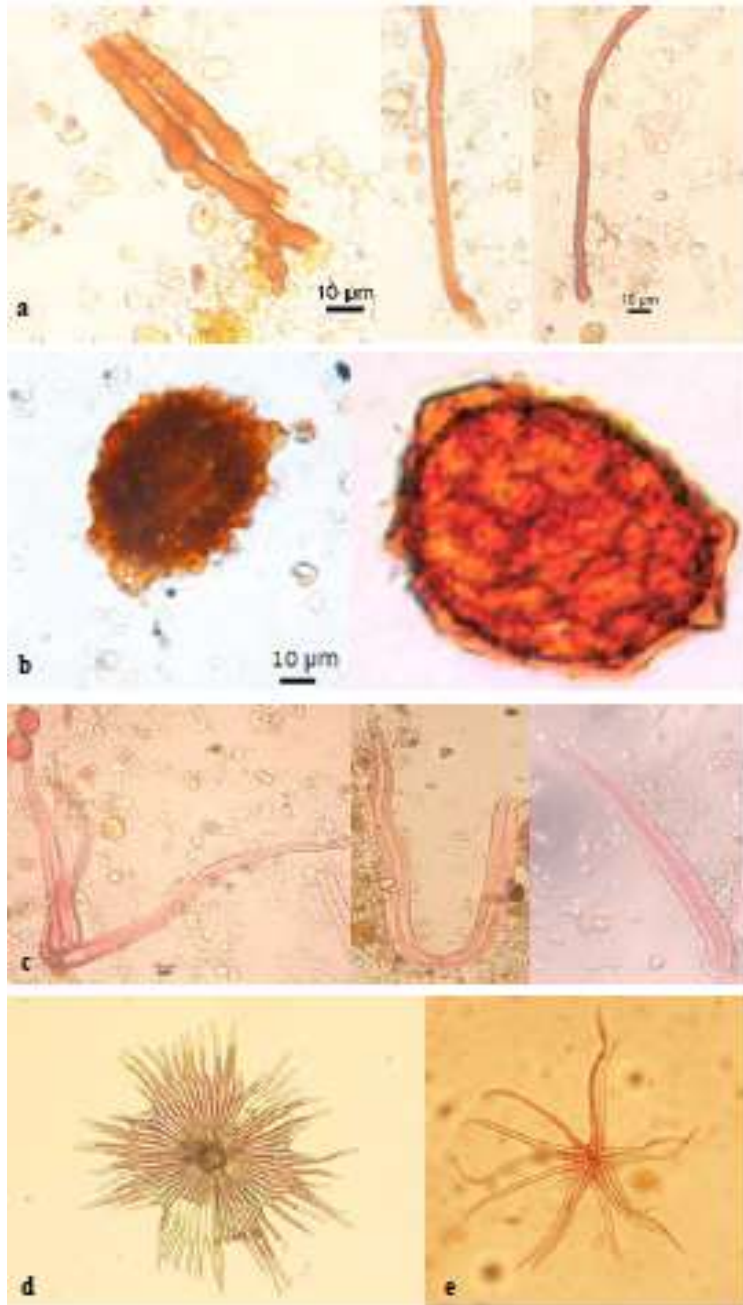


FIGURE 2. Monthly Meteorological Datas

3. RESULTS

During the study year 2015, the average temperature was 12.2 °C, in 2016 the average temperature was 12.3 °C while the average temperature for long term period (1930-2017) in Kirsehir was 11.5 °C. The warmest month was August in 2015 and 2016. The annual average rainfall for the period 1930-2017 was 31.4 mm. However, over the study period (2015) the annual average rainfall was 39.2 mm and the annual average humidity was 63.9%. In 2016 average rainfall was 41.4 mm and annual average humidity was 57.5%. The wettest month was June in 2015, January in 2016 (Figure 2).



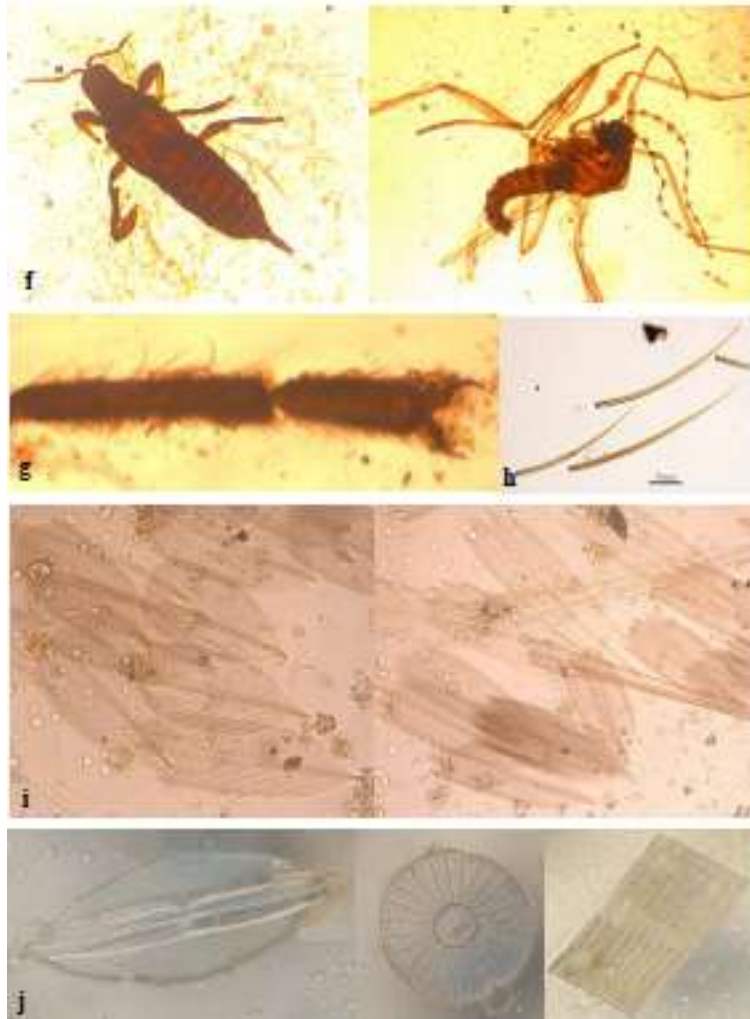


FIGURE 3. a- Fungal hyphal fragments, b- Pteridophyte spores, c,d,e- Plant hairs, f- Insects, g,h- Insect extremities and hairs, i- Moth scales, j- Diatoms

In the atmosphere of Kirsehir, a total of 4674 biological particles were observed in 2015. A total of 5262 biological particles were observed in 2016 (Figure3). Fungal hyphal fragments were seen as the densest biological particles in the atmosphere for both years (Figures 4,5). Also, monthly changes of atmospheric biological particles are given below (Table 6,7).

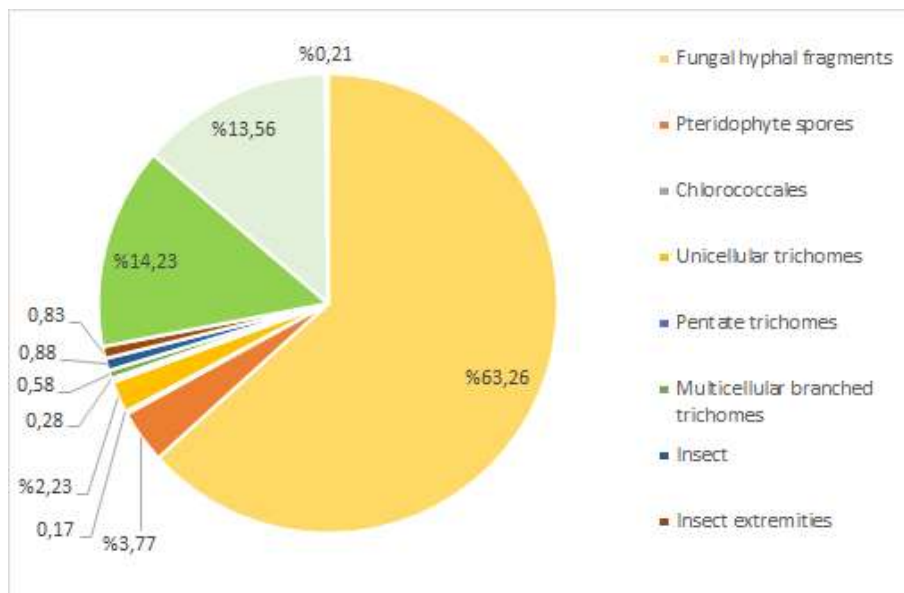


FIGURE 4. Distribution of biological particles, 2015

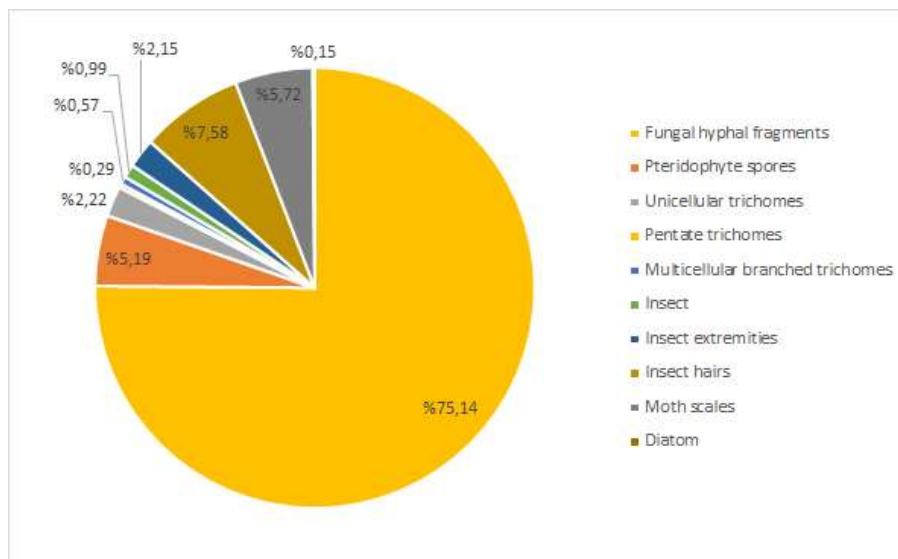


FIGURE 5. Distribution of biological particles, 2016

Months →	1	2	3	4	5	6	7	8	9	10	11	12	Total
Fungal hyphal fragments	33	75	25	161	251	664	1128	256	240	91	19	14	2957
Pteridophyte spores	0	0	19	49	23	34	22	15	11	3	0	0	176
Chlorococcales	0	0	4	0	2	0	0	0	2	0	0	0	8
Unicellular trichomes	0	0	16	20	20	11	10	12	13	2	0	0	104
Pentate trichomes	0	0	2	0	4	2	1	0	4	0	0	0	13
Multicellular branched trichomes	0	0	1	0	14	5	3	3	1	0	0	0	27
Insect	0	0	0	0	5	9	7	11	5	4	0	0	41
Insect extremities	0	0	0	4	4	2	9	3	17	0	0	0	39
Insect hairs	0	0	0	1	344	145	52	35	80	8	0	0	665
Moth scales	0	0	0	1	485	57	25	39	27	0	0	0	634
Diatom	0	0	4	0	5	1	0	0	0	0	0	0	10
Total	33	75	71	236	1157	930	1257	374	400	108	19	14	4674

TABLE 6. Monthly changes of atmospheric biological particles in 2015

Months →	1	2	3	4	5	6	7	8	9	10	11	12	Total
Fungal hyphal fragments	20	48	63	224	463	901	1284	324	458	113	30	26	3954
Pteridophyte spores	0	0	34	82	36	30	16	39	31	5	0	0	273
Unicellular trichomes	0	0	21	23	12	13	14	15	13	6	0	0	117
Pentate trichomes	0	0	2	0	5	0	4	0	4	0	0	0	15
Multicellular branched trichomes	0	0	0	0	11	7	7	5	0	0	0	0	30
Insect	0	0	0	2	9	10	5	13	10	0	3	0	52
Insect extremities	0	0	0	7	8	12	13	10	63	0	0	0	113
Insect hairs	0	0	0	7	143	85	64	30	55	0	15	0	399
Moth scales	0	0	0	0	42	42	101	87	29	0	0	0	301
Diatom	0	0	3	0	4	1	0	0	0	0	0	0	8
Total	20	48	123	345	733	1101	1508	523	663	124	48	26	5262

TABLE 7. Monthly changes of atmospheric biological particles in 2016

4. DISCUSSION

In this study, we analyzed biological particles except pollen and fungal spores in Kirsehir atmosphere for 2015 and 2016. Other biological particles found outside the pollen and fungal spores in the atmosphere have also been studied before. These particles were found to have a slight allergic effect [12-13]. Biological particles such as viruses, bacteria, fungal spores and fungal hyphal fragments carried in the atmosphere cause major destruction on farmland and natural vegetation with diseases they suffer, and also cause great financial losses with pathogenic, toxic and allergenic effects on humans and animals [7]. Edmonds classified the primary pollutants in the atmosphere as natural and human sources, and described volcanic fires, pollen, terpenes, viruses, bacteria, fungi, plant particles, algae, mites and microfauna as natural pollutants. Hyphal fragments have been observed in ambient air in several studies [14-15-16]. It is suggested that airborne hyphae are most commonly unbranched conidiophores that can be 1-100 μm in length but that are more commonly 5-40 μm [17]. Similarly, the most common biological particles were fungal hyphal fragments for both years in our study and they were generally

unbranched with 20-200 µm in length (Figures 3,4). Also, trichomes were found secondly dominant among the biological particles in atmosphere and since the plant trichomes perform defense function, they may show irritant effects as well as allergic effects in humans when they are taken by respiration due to the various acids and foliage they contain [18]. At low concentrations, algae, fern spores and diatomaceous were found in Kirsehir atmosphere. It is reported that single-celled algae or algae fragments could be retained by the respiratory tract mucosa for bending and thus play a role in respiratory diseases and allergies [7]. Also, in the atmosphere of Kirsehir, insect, insect extremities, insect hairs, moth scales were found. Mites and micro-fauna particles are allergic and irritant as well, when inhaled. The importance of knowing the periods and intensities of these airborne particles is quite crucial for sensitive individuals to take protective measures and to take necessary precautions for people who works in agricultural and natural areas.

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