MINI REVIEW

# Temperature and relative-humidity wise variation of aerial microflora

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**ABSTRACT**

Quantum Aerial microbes like bacteria and fungi can cause many allergic and invasive disorders. They can vary according to temperature and relative humidity and this of public health importance. This is important to declare new infection control policy by scientists and environmentalists.

**Key Words:** *Air; Settle plate; Temperature; Humidity*

## INTRODUCTION

Airborne bacteria and fungi can cause many allergic and invasive diseases. They often vary with variations in ambient temperature and relative humidity. Bioaerosols in air cause allergic and infectious disorders. Bioaerosols may be microbial, like fungi, bacteria, and viruses, and non-microbial like dust, skin particles, and pollen. However, this has not been studied extensively yet. No comprehensive data is there for this also in the scientific literature. However, this is of great public health importance. This variation is especially true for fungal genera like *Cladosporium* spp., *Penicillium* pp., and *Aspergillus* spp. which show seasonal variation [1]. Both temperature and relative humidity may greatly affect bioaerosol precipitation. Particularly, relative humidity has been shown to have a deep impact on spore and particle release from fungal structures with which surfaces are infested [1,2]. In fact, studies are going on to see the effects of parameters like temperature, humidity, sunlight or radiation, and pollution on the survival of airborne microorganisms. Humidity in this context may be relative or absolute. Sunlight may imply exposure to Ultraviolet rays in the atmosphere [3]. Knowledge of these things may help policymakers in formulating specific airborne or aerosol infection control guidelines [3]. Also, with the increasing importance of aerosol-transmitted allergic and invasive microbial infection in both man and livestock, knowledge of these aspects is becoming more and more important. For instance, hypersensitivity pneumonitis has been seen with exposure to *Streptomyces albus* in the air [4]. Variation in fungal flora of air has been reported earlier. It has been shown that in places like Connecticut, USA, *Cladosporium* spp. is generally dominant in both indoor and outdoor air in summer. On the contrary, *Penicillium* spp. and *Aspergillus* spp. are widely found in indoor air in winter [5]. Bioaerosols are found in the air quite naturally and originate commonly from rotting leaves and soil and other such sources. Microbes can be seen in the air as both wet and dry aerosols. It is also a fact that airborne dust particles might play a very important role in the transport and survival of bacteria and viruses. Other than microbes per se, their toxins and endotoxins can also circulate in ambient air and cause conditions like sick building syndrome. Apart from moisture and relative humidity, ambient temperature is also important for aerial microbial flora. Most of the bacteria in the air are mesophilic and hence are mostly found in ambient temperatures from 25°C to 40°C. Below 18°C bacterial growth usually is rare [6]. Similarly, moisture is air from 20% to 60% is essential for the growth of bacteria and fungi in the air. Very rarely a microbe grows in air below a relative humidity of 20% [6]. This variation in Aerial flora is true for both outdoor as well as indoor air. Studies have mostly found endospore-producing Gram-positive rods in the outer air. Out of all the factors influencing this change or alteration in the microbial flora of air, the 2 most important factors are temperature and UV radiation [7]. Nevertheless, some recent studies have pointed out that there is no direct relationship between air humidity and fungal growth, because even if very low humidity molds can grow if there is surface water available [8].

## MATERIALS AND METHODS

We collected data from other researchers and also calculated our own findings. We employed the settle plate method using CLED for bacteria and SDA for fungi.

Egg yolk agar, CLED and Sabouraud's Dextrose agar (SDA) plates were used for sampling of both indoor and outdoor air by settle plate method at different times of the day, e.g. from 1 pm to 2pm, and from 3 pm to 4 pm. Plates were kept for 1 hour, 3 feets away from nearest wall and 3 feet above the floor (Figure 1).

Temperature and relative humidity were measured by an instrument called digital hygrometer, shown in Figure 2.


**Figure 1)** *Bacterial colonies on egg yolk agar as seen by settle plate method*

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**Figure 2)** *Digital hygrometer showing ambient temperature, time and relative humidity (anticlockwise from top).*

Our experience showed that aerobic spore-bearing Gram-positive bacilli were found more in afternoon samples than in the morning or noon samples. Filamentous fungi were also found more with an increase in relative humidity. According to other studies and also seconded by us, the bacterial count as well as the variety was more in the daytime and less in the afternoons. With the increase in temperature and relative humidity, most of the bacteria showed higher counts of colonies in the same area, both indoors and outdoors. However, none of air samples showed a very high CFU count of bacteria. *Bacillus* spp. was found more in the outer air in the noon time than an afternoon. Staphylococci could be found all throughout the day. The diurnal variation of fungi like yeasts and molds is found to be less, however. However, mold colonies were found more in afternoon samples. Bacteria were found more in number in the morning and molds more in the afternoon. Bacterial colonies were found more in variety and number if relative humidity exceeded 60%. In all cases, relative humidity ranged from 40% to 70%. In SDA media, in rooms that have not been fogged recently, a large aerial load of *Aspergillus* spp. was found. They were found more in afternoon sampling Other authors have found that bacteria like *Escherichia coli*, *Enterococcus mundtii* and *Mycoplasma synoviae* can survive well in a temperature range of 10°C-30°C and relative humidity of 40%-80% [9].

## CONCLUSION

Microbial aerosols may be associated with ventilation and air conditioning systems. Ambient temperature and relative humidity are very important factors controlling the pattern of microbial flora in air. The importance of this phenomenon is being realized now and will help devise strategies to mitigate infection and allergy due to airborne pathogens. Scientists have used the settle plate method as well as other means like cascade impacts to study aerial flora and its variation with respect to temperature and relative humidity. However, other factors also come into play in deciding this variable pattern, like building or room occupancy and design of the concerned building [9,10]. This is undoubtedly a very interesting area of public health research. Policies need to be framed for this to allow or disallow susceptible hosts to venture out, keeping in mind the alterations in bacterial and fungal flora of air with respect to temperature, time and relative humidity. More research is required in this field and one health specialists can be involved also.

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