

Gumru Vasif Balakhanova

Azerbaijan State Pedagogical University

PhD student

19_bq_91@mail.ru

Orcid: 0000-0002-1709-1442

DETERMINATION OF MYCOBIOTA OF ANTHROPOGENIC ENVIRONMENTS GENERAL CHARACTERISTICS BY FREQUENCY

Abstract

In modern times, due to the rapid urbanization, construction works have reached a large scale. However, unfortunately, in the construction of new residential complexes, the standard norms of both construction and environmental conditions are almost not followed. In this regard, the analysis of ecomorphic fungi capable of living in different environmental conditions on the basis of topical and trophic criteria reflects their situation and trophic relationships even in the local ecosystem. Also, the fact that the ecosystems are not closed or are an open system allows fungi to migrate to the ecosystem in different ways, and their heterogeneous groups belonging to separate systematic categories settle on different substrates and perform functional activities in unity. It is known that the ability of fungi to adapt to new environmental conditions and settle on the substrate is the basis for the formation of mycobiota in this or that ecosystem. It has been determined that microscopic fungi inhabiting buildings of various purposes not only deteriorate the quality of various objects and materials placed inside the rooms, but also have a very negative impact on the health of people living and working here. Therefore, the main goal of the conducted research was the mycological assessment of the ecological situation in new residential complexes.

Keywords: residential buildings, microscopic fungi, mycobiota, micromycete, pathogenicity

Qumru Vasif qızı Balaxanova

Azərbaycan Dövlət Pedaqoji Universiteti

doktorant

19_bq_91@mail.ru

Orcid: 0000-0002-1709-1442

Antropogen mühitlərin mikobiotasının rastgəlmə tezliyinə görə ümumi xarakteristikası

Xülasə

Müasir dövrdə sürətli urbanizasiya ilə əlaqədar tikinti işləri geniş miqyas almışdır. Lakin, çox təəssüflər olsun ki, yeni-yeni yaşayış komplekslərinin salınmasında həm tikinti-konstruksiya, həm də ekoloji vəziyyətin standart normalarına demək olar ki, əməl olunmur. Bu baxımdan müxtəlif mühit şəraitlərində yaşamaq qabiliyyətinə malik olan ekomorf göbələklərin topik və trofik kriteriyalar əsasında analiz olunması, onların hətta lokal ekosistemdəki vəziyyətlərini və trofik əlaqələrini əks etdirir. Habelə, ekosistemlərin qapalı olmaması və ya açıq sistem olması, göbələklərin ekosistemə müxtəlif yollarla miqrasiyasına, onların ayrı-ayrı sistemə kateqoriyalara aid heterogen qruplarının fərqli substratları üzərində məskunlaşaraq, vəhdət halında funksional fəaliyyət göstərməsinə şərait yaradır. Məlumdur ki, göbələklərin yeni ekoloji şəraitə uyğunlaşması və substrat üzərində məskunlaşması qabiliyyəti mikobiotanın bu və ya digər ekosistemdə formalaşmasının əsasını təşkil edir. Müəyyənləşdirilmişdir ki, müxtəlif təyinatlı binalarda məskunlaşan mikroskopik göbələklər, nəinki otaqlar daxilində yerləşdirilən müxtəlif əşyaların və materialların xarab olaraq keyfiyyətinin aşağı düşməsinə, eyni zamanda burada yaşayan və çalışan insanların sağlamlığına da çox mənfi təsir göstərilmişdir. Odur ki, aparılan tədqiqatın əsas məqsədini də yeni yaşayış komplekslərində ekoloji vəziyyətin mikoloji qiymətləndirilməsi təşkil etmişdir.

Açar sözlər: yaşayış binaları, mikroskopik göbələklər, mikobiota, mikromiset, patogenlik

Introduction

Fungi can be found on land, in water, in air, in wet soils, on other living things, in short, on all substrates that allow them to live and feed. The substrate is not only a place of residence of the mushroom individual, but also a source of food. As a result, in the biocenosis where the fungus exists, trophic (food) and metabiotic (use of metabolic products) relationships are formed between it and other organisms. In which, in the trophic relationship, either the living fungus existing in the ecosystem, or the mushroom itself, becomes the direct food of some organism, and in the metabiotic or metabolic relationship, either the fungus absorbs the metabolic products of another organism, or vice versa. While fungal individuals can completely occupy the substrate in the artificial substrates selected for research purposes, this does not happen in natural substrates. Because both living and non-living components of natural substrates show resistance to it. To overcome this, the mushroom must have strong growth energy. This increases its competitiveness. Its competitiveness in the substrate should be determined not only by its growth energy, but also by its strong decomposing exoenzymes (exoproteases) from its metabolic products, mycotoxins, as well as the ability to tolerate antibiotics used by other organisms against them. It is strange that since almost all fungi have a well-developed ability to adapt to the environment, sometimes the negative factors of the substrate for the fungus, on the contrary, cause its latent spores to quickly wake up and germinate, thus moving away from unfavorable conditions.

Wider use of fungi capable of synthesizing various biologically active substances, especially micromycetes, is a common reality of recent times, but in addition to all this, microscopic fungi (micromycetes) infecting agricultural plants and products, forest plants, domestic animals, as well as the human body. causes great damage by causing diseases of various origins. At the same time, in objects of various purposes, more precisely in objects of various purposes related to the life activity of people to one degree or another (places where people live, study, work, rest, stay for a certain period of time, etc.), to be more precise, in anthropogenic environments Microscopic fungi inhabiting are particularly active in the biodegradation of various materials and in the pollution of fresh water basins. Microscopic fungi that live on various objects, devices and equipment placed in residential buildings and made of wood materials cause their quality to decrease, as well as to become potential sources of spread of various allergic diseases (Alkişiyeva, Seyidova, 2015).

It should be noted that anthropogenic environments are one of the places where organic matter, which serves as a food source for fungi, is more widespread. Therefore, microscopic fungi, which do not face any difficulties due to their spread, easily settle in such places. Considering that various anthropogenic environments are permanent residences or workplaces of people, it is very important to study the microscopic fungi or micromycetes that inhabit them from various aspects comprehensively from the point of view of their health.

The conducted studies show that there are many types of microscopic fungi that cause diseases of various origins in humans. Some of them settle on a healthy organism and are potential pathogens, while some of them are obligate pathogens and can pose a serious threat to human health and are the source of any disease (Sutin, Zelenskaya, Finn, 1968).

In recent times, intensive construction works are being carried out in Azerbaijan, especially in the city of Baku, which naturally leads to an increase in the demand for construction materials. It is clear that the rapid increase in demand makes it inevitable to bring or produce a large amount of construction materials to the country. In some cases, due to economic interests being more prominent, the storage conditions (temperature-humidity regime) of construction materials brought from abroad or produced in the country until they are used do not comply with the norms. It is for this reason that the possibility of their spoilage and infection with microorganisms is extremely high. The occurrence of the latter leads not only to the destruction of materials, changes in their visual image, but also to a significant deterioration of the environmental conditions of the objects built with their use, primarily those intended for living.

People living in modern residential buildings use air conditioners more often to protect themselves from heat or cold. On the one hand, it regulates people's lives, but on the other hand, it is a source of potential danger to their health. Thus, condensed moisture or capillary moisture increases the humidity of materials of different composition inside the room and creates favorable

conditions for the development of micromycetes on their inner surface. At this time, the moistening of the lower part of the plasters of different compositions applied to the walls or the lower part of the painted paper (wallpaper) in the form of liquid drops wakes up the micromycete propagules from the state of anabiosis, and they move to an active lifestyle and reproduce massively. The dominant core of the mycobiota formed in the rooms decorated with decorative papers was identified, which includes *Aspergillus flavus* Link, *A. fumigatus* Freen, *A. versicolor* Tiraboshi, *Acremonium charticola* Gams, *Cladosporium herbarum* Link, *Stachybotrys chartarum* Hughes, *Ulocladium atrum* Preuss and *U. chartarum* Simmons species. By the way, let's note that *Acremonium charticola* Gams, *Stachybotrys chartarum* Hughes and *Ulocladium chartarum* Simmons have become members of the dominant nucleus within the mycobiota, which means a very serious violation of mycological safety. Because these mushrooms are very strong toxins, they are considered a risk factor for human health (Zeynallı, Kərimov, Cəbrayılzadə, Qəhrəmanova, 2009).

If we add to what we have said that there is no literature information about conducting such research in Azerbaijan, then there is no need to prove the importance of conducting research in this direction.

In the field of studying the mycobiota of buildings of various purposes, certain research works are also being carried out in Azerbaijan. In recent years, the increase in population in Baku, the capital of our republic, due to known reasons, the rapid construction of high-rise buildings, and the mycological safety of the population living in these buildings reveal the need to conduct mycological studies in this direction. At the same time, if it is taken into account that the built buildings are built at very close distances to each other, regardless of how much they are regulated by urban planning laws, then it is self-evident how important it is to study the mycological condition of not only old, but also new buildings built in our city. From this point of view, in a big city like Baku, which is the capital of our republic, there are various types of accommodation, hospital, library, culture, etc. in the mycological aspect of catering buildings, in other words, the spread of fungi, the study of their eco-taxonomic characteristics is of both scientific and practical importance (4).

In modern times, due to the rapid urbanization, construction works have reached a large scale. However, unfortunately, in the construction of new residential complexes, the standard norms of both construction and environmental conditions are almost not followed. In this regard, the analysis of ecomorphic fungi capable of living in different environmental conditions on the basis of topical and trophic criteria reflects their situation and trophic relations even in the local ecosystem. Also, the fact that the ecosystems are not closed or are an open system allows fungi to migrate to the ecosystem in different ways, and their heterogeneous groups belonging to separate systematic categories settle on different substrates and perform functional activities in unity. It is known that the ability of fungi to adapt to new environmental conditions and settle on the substrate is the basis for the formation of mycobiota in this or that ecosystem. Therefore, the main goal of the conducted research was the mycological assessment of the ecological situation in new residential complexes.

Microscopic fungi inhabiting buildings of various purposes not only deteriorate the quality of various objects and materials placed inside the rooms, but also have a very negative impact on the health of people living and working here (5).

Wood, stone, plastic, metal, etc. in residential buildings of various purposes. comparative analysis of the species composition of microscopic fungi anchoring on the materials revealed that even the lowest frequency of fungi can be found on plant products. This is due to the fact that wood materials contain a larger amount of organic carbon sources than stone, plastic and metal materials.

Improper operation of residential buildings, violation of the hydrotechnical regime, and in general, unsanitary conditions in the rooms lead to an increase in the pathogenicity of the mycobiota and the creation of a potential source of infection.

The conducted studies prove that the effect of microscopic fungi inhabiting different buildings used as living and working places (library, museum, cinema-theater, etc.) on building materials of different composition is carried out in a destructive aspect. Some fungi cause great damage to human life by destroying works of art, books, furniture, paint coatings, construction materials, oil

products, paper, cloth products and causing rapid corrosion of metal products. In particular, *Penicillium purpurogenum* forms purple-red mycelial colonies on books and paintings and negatively affects their quality (6).

Serpula lacrymans, a member of the *Serpula* genus, is a fungus that damages wooden parts in the basements of houses and causes them to rot. That's why these mushrooms are also called "house mushrooms". As a result of the activity of special house fungi, which are more adapted to construction conditions, destructive decomposition occurs in wood, that is, the cellulose part of its cells is decomposed (Axundov, 2008: 71). The wood darkens in color, loses its strength as it dries, and crumbles into dust-like particles under low pressure. First of all, it should be noted that micromycetes subject the building materials on which they live to mechanical decomposition.

The unique microclimate conditions formed in the rooms of different statuses of residential buildings play an important role in the settlement of microscopic fungi and are considered one of the main tools in managing their number. It should be noted that the failure to carry out cleaning work on time or delaying it for a long time leads to the formation of a mass of dust in the rooms, which is also called household dust. Household dust is a special anthropogenic substrate, consisting of sand and soil particles, fibers of wool, cotton and synthetic materials, pollen of plants, pieces of hair belonging to humans or animals, metabolites of synanthropic animals, micro-remains of the epidermis of humans and animals. Thus, household dust generated in rooms with different status as a rich food environment is considered a fertile environment for the formation of various associations of the heterotrophic block, including mycobiota. One of the fungal diseases observed on the skin of people in residential buildings is zygomycosis. The causative agents of this disease settle mainly on decayed organic substrates inside the building, then multiply and increase their number and migrate to the surface of the skin of people. Micromycetes belonging to the genus *Rhizopus* are considered to be the causative agents of zygomycosis. *Rhizopus stolonifer*, *Rhizopus johnii*, *Rhizopus microsporus*, *Rhizopus oryza*, *Rhizopus nigricans*, *Rhizopus nodosus* species are also pathogenic and cause decay (Namazov, 2019: 142). These species are particularly active in the spread of this disease among people in residential buildings.

The conducted studies show that fungi belonging to the genus *Rhizopus* and spreading in residential buildings are characterized by a rapid growth process in an environment with an organic substrate and are resistant to temperature. Aerial hyphae appear in the colonies formed on the substrates, sporangia and spores are formed in them after a certain period of time, and they spread inside the room by means of air currents.

Recently, mold fungi have attracted attention because they secrete substances called antibiotics that kill microbes (Axundova, 2015: 27). The gender composition of micromycetes living in modern residential complexes and improper installation of windows, poor-quality installation work, causes the appearance of moisture condensates in the frames of doors and windows, which ultimately creates favorable conditions for mold growth and the development of mold fungi. In general, emergency situations occurring in residential buildings disturb the relative stability of the component composition of mycobiota, in other words, they ensure the formation of anamorphic, teleomorphic biological forms or other fungal associations within the mycocomplex. Thus, the teleomorphic biological forms of micromycetes that spread in the air space of residential buildings are usually in anabiosis state. However, the increase in humidity has a strong effect on the state of anabiosis of teleomorph biological forms and accelerates the process of conidiogenesis. Therefore, to ensure the mycological safety of people living or working in modern residential complexes, regular mycological assessment of the ecological situation is extremely important.

It is known that there are small pores or microcracks on the building materials used in the construction of residential buildings. Localization of micromycetes on building materials and penetration into it is carried out by means of mycelia from these areas. Thus, microscopic fungi anchored both on the surface and inside of different types of materials in residential buildings, after a certain period of time has passed, in other words, after completing the adaptation period, they rapidly and massively multiply and form colonies of various shapes. Precisely after the formation of these fungal colonies or propagules, micromycetes biodegrade the materials on which they live with the help of a powerful enzyme system.

It is worth noting that furniture items are the first to be exposed to the process of biodamage by micromycetes in residential buildings of various purposes. As it is known, various types of furniture are produced primarily from wood material, in other words, it is a plant-based product. Therefore, microscopic fungi settle on the furniture and use it as a carbon source. If we take into account that, in general, fungi are deprived of the process of photosynthesis, then the essence of their use of various materials, even glass-textile materials, as a carbon source becomes clear by itself. At the same time, it is also a fact that the end of the fungus-substrate interaction results in the process of biodestruction. In the intensification of this process, the humidity of the environment where these materials are located, as well as the moisture of the material itself, is of particular importance. For example, from the studies conducted in connection with the study of biodamages, it is clear that there is a direct correlation between the moisture content of the material and the number of fungal spores that inhabit them. True, this issue is not confirmed in completely dry materials in old buildings.

Thus, the fungal-substrate interactions are the basis of the biodegradation process of plant-based furniture in residential buildings of various purposes.

Numerous studies prove that the process of biodamage of furniture in residential buildings is mainly carried out by *Aspergillus awamori* and *Aspergillus versicolor* species of *Aspergillus* genus from micromycetes (10). It is also known that the floors of residential buildings of various purposes in Baku, including schools, universities, hospitals and clinics, offices and institutions, etc., are usually made of wooden parquets. In residential buildings, wiping things with water several times during the week leading to sanitary-preventive work causes dampness and increased humidity. This creates favorable conditions for the development of mycobiota living in wooden parquets, and their biodestructive activity increases. At the same time, since all rooms in residential buildings are fully equipped with a heating system, the rooms are sufficiently warmed up. Thus, normal sanitary-hygienic conditions created for people living or working in residential buildings of different purposes are considered optimal conditions for the reproduction and development of mycobiota living in residential buildings. In other words, the micromycetes living here take advantage of the normal conditions artificially created in residential buildings, abusing them for their own purposes and carrying out the process of biodamage of various materials (11).

It should be noted that the chemical composition of the substrates plays an extremely important role in the formation of the species composition of the micromycete associations living on substrates with different chemical composition in residential buildings and, undoubtedly, in their vital activity.

It is known that in residential buildings, in addition to herbal products, stone, plastic, metal, etc. materials are also used. For this purpose, wood, stone, plastic, metal, etc. are used in residential buildings of various purposes. A comparative analysis of the species composition of microscopic fungi anchoring on materials revealed that even fungi with the lowest frequency of occurrence can be found on plant products. This is due to the fact that wood materials contain a larger amount of organic carbon sources than stone, plastic and metal materials. Therefore, the study of the chemical composition of various materials used in residential buildings by standard methods proves that the settlement of microscopic fungi on the substrates is not accidental, but happens in a regular way. It goes without saying that the process of biodamage caused by micromycetes will be different depending on the chemical composition of the substrates.

As it can be seen, microscopic fungi inhabiting buildings of various purposes not only deteriorate the quality of various objects and materials placed inside the rooms, but also have a very negative effect on the health of people living and working here.

Our comparative studies show that under natural conditions, the fungal associations formed by these fungi on the above-mentioned materials of different composition are very uniform in terms of species composition. So, at this time, the fungal associations are either *Aspergillus niger*, *Alternaria alternata*, *Fusarium moniliforme*, or *Trichoderma viride*. By the way, let's note that in natural conditions, the process of biodegradation of materials of different composition by micromycetes is close to each other as a result (12). Apparently, the conducted research also proves that one of the permanent inhabitants of the environment where people live is fungi. In this regard, it is very

important to study the distribution patterns of micromycetes, which are the main source of various diseases in anthropogenic biotopes. It is known that mycosis and mycogenic allergy diseases are observed among people who spend most of their time in covered buildings. These diseases are mainly caused by potential pathogens in the urban environment.

It should be noted that in the association of microscopic fungi living on materials with different chemical composition, *Aspergillus niger*, *Aspergillus versicolor*, *Penicillium chrysogenum*, *Penicillium variable*, *Penicillium funiculosum*, *Penicillium cuclopium*, *Alternaria alternata*, *Trichoderma lignorum*, *Trichoderma viride*, *Cladosporium herbarum*, etc. species are selected by their special activity. So, the frequency of occurrence of the above-mentioned fungi on materials of different composition in residential buildings, as a rule, is always characterized by high indicators, and it is likely that this is related to the direct organic properties of micromycetes (13).

The ability of fungi to adapt to new environmental conditions and settle on the substrate is the basis for the formation of mycobiota in this or that ecosystem. The main goal of the conducted research was the mycological assessment of the ecological situation in new residential complexes.

Research conducted in a number of scientific centers of different countries shows that in recent years, the interest in the mycological study of buildings that have been affected by anthropogenic influence and are used for one or another purpose in the urban environment is increasing day by day. Because after a certain period of use of such objects, it can be said that they become less useful or completely unusable, as well as the health problems of people living or working here are a real reality, and the main spectrum of allergies caused by mycelial fungi is closely related to the mycobiota of a specific region. Therefore, before preventive measures to be taken in order to improve the sanitary-epidemiological and sanitary-hygienic condition of residential buildings of various purposes, it is necessary to comprehensively study the mycobiota of the region where they are located, first of all, to determine its taxonomic structure.

In recent times, intensive construction works are being carried out in Azerbaijan, especially in the city of Baku, which naturally leads to an increase in the demand for construction materials. It is clear that the rapid increase in demand makes it inevitable to bring or produce a large amount of construction materials to the country. In a number of cases, especially because economic interests are more prominent, the storage conditions (temperature-humidity regime) of construction materials brought from abroad or produced in the country must be in accordance with the norms until they are used (14).

Conclusion

- The infection of the investigated buildings with different purposes by these fungi is mainly due to the humidity-temperature factor of the residential buildings and the environment, the age and service life of the building, as well as the type and quality of the materials from which the building was constructed, the industry used during restoration (restoration) and repair. It depends extremely on the composition and quality of the products, and, no doubt, on the level of use of buildings with different purposes.

- In order to prevent the contamination of buildings with different purposes by microscopic fungi, it is necessary to determine each of the above-mentioned factors in detail in buildings with different purposes and keep them at a level consistent with the standards determined by the International Health Organization.

- It is necessary to carry out a comprehensive technical inspection of residential buildings and determine the duties of the responsible persons responsible for these works.

- Only after that, in buildings with different purposes, it is possible to reduce the impact of the above-mentioned factors and limit the area of sources of disease infection, which actually means protecting the living conditions, work activities, and health of people living or working in buildings with different purposes (15).

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