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Characteristics of the mycobiota of cultivated plants grown in the Kur-Araz valley according to ecolo-trophic relationships

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ABSTRACT

As is known, there is a complex system of mutual relations between plants and microorganisms, primarily fungi. By synthesizing various biologically active substances, fungi either negatively affect plants or stimulate the metabolic processes occurring in them. At the same time, fungi, by settling in plants, use them as food sources, and in this case, fungi also affect the processes occurring in plants by causing various pathologies. The clarification and more precisely the study of all these relations has always aroused interest from both theoretical and practical points of view and this issue still retains its relevance today. The relevance of research conducted in this direction has increased somewhat since the second half of the 20th century in terms of solving the problems faced by humanity, such as the lack of energy, nutrients, as well as raw materials for various production sectors. Thus, plants are one of the main sources for people to obtain various products (food, feed and medical), and only 10% of the green biomass formed as a result of photosynthesis is used to meet the needs of the world's population for these products. Cultivated plants are of particular importance in meeting this need. However, these plants are the main source of meeting the needs of not only humans but also other living beings for food and energy. The use of this source by other living beings leads to the emergence of the above-mentioned deficiencies, which are increasingly noticeable. Among the factors that cause this are various diseases caused by a number of living beings living in plants. Thus, every year, at least 10% of the products obtained from cultivated cultivated plants are lost as a result of pathologies caused by fungi alone.

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INTRODUCTION

The Kur-Araz lowland is the largest plain in Azerbaijan and occupies the largest area in the agricultural sector, especially in terms of irrigated lands. Until our research, this area, with the exception of the Mughan plain , has not been the subject of systematic research in mycological aspects. If we add to the above that the spread of fungal diseases, as well as the quantitative indicator of the virulence of a pathogen considered to be the cause of this or that disease, is also related to environmental factors, then the need to conduct research in the Kur-Araz lowland based on the principle of "a specific approach in specific conditions" is beyond doubt. Therefore, in the research conducted, we first studied the area, that is, the Kura-Araz plain, which is the main geomorphological units of the Republic of Azerbaijan, located between the Greater Caucasus, the Lesser Caucasus (together with the Karabakh plateau) and the Talysh mountains, and which forms the basis of the flat part of the country's territory (more precisely, in the Aran economic region) the species composition of the fungi associated with cultivated plants was determined. From the obtained results, it became clear that 112 species of fungi and mushroom-like organisms are distributed in the vegetative and generative organs of cultivated plants in Kura-Araz plain (Yusifova *et al*. 2025; Subramanian, 1971).

MATERIALS AND METHODS

As it was mentioned in the previous parts of the work, since the systematics of fungi is the object of discussion even today, there is no unified system accepted by everyone. For this reason, mainly in research, it was considered appropriate to give preference to the system used on the official website of the International Mycological Association (IMA). Most of the recorded fungi belong to the anamorphic forms of sac fungi (76 species), that is, the undefined (Deuteromucota) fungi that are still widely used in the literature. The next places are occupied by fungi belonging to the department Basidiomycota (13 species), Zygomycota (6 species) and Ascomycota (telemorphs) (7 species). Fungi-like organisms, that is, belonging to the order Chromista, are represented by 10 species, which makes up 8.9% of recorded fungi.

RESULTS AND DISCUSSION

Anamorphic fungi have a relative superiority in terms of the number of species in the mycobiota of any area. For example, research conducted in Russia found that the vast majority of fungi observed on ornamental plants belong to anamorphic fungi, and it was shown that 126 of the 154 species related to parasitism among the recorded fungi belong to anamorphic fungi. 91 (52.9%) of the 172 mushroom species recorded in the Mugan plain, 72 (82.8%) of the 87 species recorded in essential oil plants, and 69 of the 86 species recorded in the plants cultivated on the Absheron Peninsula (80.2%) was determined to belong to anamorphic fungi (Aslanova, 2025; Nicholson *et al.,* 2003; Yusifova *et al.,* 2024).

When the recorded mycobiota is characterized by its genus composition, it becomes clear that fungi belonging to the genera Penicillium and Fusarium are represented by more species (8 species) in the formation of the mycobiota of cultivated plants in the Kura-Araz plain. Ascochyta and Septoria fungi are represented by 7 species in this process. 6 species of Aspergillus genus, 5 species of genera such as Alternaria, Colletotrichum and Phoma participate in the formation of the mycobiota of the studied plants. The remaining genera are represented by 1-4 species in the formation of this or that plant, as well as the general mycobiota of the area.

Although the representation of one or another genus in the mycobiota of any area or plant opens up certain perspectives for the possibility of using fungi as indicators, it is not always appropriate to take this as an indicator of their dominance. For example, the genera Botrytis and Rhizopus are represented by only one species in the formation of the mycobiota of

cultivated plants in the Kura-Araz plain, but they can almost use the majority of the cultivated plants as food.

Comparing the obtained results with the results of the mycological studies conducted in Azerbaijan until now, it is clear that the distribution of some fungi in the nature of Azerbaijan is unknown, and the number of such fungi is equal to 11, which consist of the following species:

1. *Mucor corticola* Hagem
2. *Penicillium stoloniferum* Thorn.
3. *P. puberulum* Bainier
4. *Verticellium pulverulentum* Couwenteg
5. *Phoma roumii* Fron.
6. *Ph. minulella* Sacc et. Penz.
7. *Dicoccum asperum* (Corda) Saccardo
8. *Ascochyta anethicola* Sacc.
9. *Asc. pinodes* (Berk.et. Blox) Jones.
10. *Sclerotinia borealis* Bubak et Vleugel.
11. *Septoria sojina* Thuern

According to the system given on the official website of BMA, 1 of the fungi recorded in the nature of Azerbaijan for the first time belongs to zygomycetes (Mucor corticola), 1 - to telemorphs of sac fungi (Sclerotinia borealis), and the rest to anomorphs of sac fungi.

It should be noted that currently most researchers believe that the number of mushroom species known to science today is 5-10% of the actual number in nature. In research conducted in a small area of the world such as Kura-Araz, the discovery of many species that are new to that area, as well as in other researches conducted in Azerbaijan, both for the mycobiota of Azerbaijan and new species for science the discovery of its spread also proves the correctness of the mentioned idea once again.

As for the distribution of fungi recorded in the study area on individual plants, it became clear that the distribution of fungi on plants is uneven, and among the studied cultivated plants, tomato and wheat are characterized by a relatively rich mycobiota, while garlic is characterized by a low mycobiota (Table 1).

Thus, 32-34 species are involved in the formation of the mycobiota of tomatoes and wheat, and only 4 species are involved in the formation of the mycobiota of garlic. 10-29 species are involved in the formation of mycobiota of the rest. This is confirmed by the data in table 3.1. As can be seen from the table, the host plants of fungi can be conditionally divided into 3 groups, the first group includes those with more than 20 species of mycobiota, the second group includes 10-20 species involved in the formation of the mycobiota, and the third group includes those with less than 10 species of fungi. . According to the mentioned division, the vast majority of plants (tomato, wheat, barley, corn, watermelon, walnut, eggplant, beans, sugar beet, etc.) should be included in the first group. The second group includes soybeans, potatoes, pumpkins and cotton, and the third group includes vegetables such as cabbage, millet, onions and garlic.

In our opinion, the uneven distribution of fungi according to the number of species on plants is due to several reasons.

The first one is related to the fact that plants characterized by a rich mycobiota and conventionally included in the first group are more massively cultivated in the studied areas. In this case, it is considered favorable conditions for the species specific for the mycobiota of this or that plant to repopulate that plant in the next vegetation year.Secondly, the biochemical nature of the composition of the plants itself also plays a certain role in this matter, as in the case of garlic, that is, the fact that the plant itself has antibiotic activity is considered to be one of the factors that cause the deterioration of its mycobiota.

Finally, the last in this matter is the degree of mycological purity of the seeds themselves used for planting. So, it is one of the confirmed facts that seeds also play a certain role in the spread and

transmission of this or that fungal disease. This is due to the fact that the organization of the mycological examination of the seeds used for planting is not at the desired level today, sometimes the mycological purity of the seeds for planting is used by visual assessment of the ones obtained in an artisanal way, etc. also confirms.

There is another point of interest from the results obtained regarding the distribution of fungi on individual host plants. This is due to the fact that not all taxonomic groups of fungi are involved in the formation of the mycobiota of some plants. For example, representatives of 3 departments are not involved in the formation of the mycobiota of cotton, 2 in the formation of the mycobiota of watermelon, cabbage, garlic and onion, and 1 in the formation of the mycobiota of barley and corn. In our opinion, it would be correct to look for the reason for this both in the biochemical composition of plants and in the mutual relations between fungi belonging to separate taxonomic groups.

Table 1. Distribution of fungi on individual plants

Plants	Taxonomic relationship of mushroom species					Total
	Oomycota	Zygomycota	Ascomycota		Bazidiomycota	
			Telemorf	Anamorf		
Wheat	2	1	3	22	4	32
Barley	0	1	2	22	4	29
Corn	0	1	1	18	3	23
Watermelon	1	1	0	21	0	23
Tomato	2	1	1	29	1	34
Eaten	1	2	0	28	0	31
Cabbage	1	0	1	6	0	8
Potato	1	0	0	11	2	14
It's a beet	2	2	3	18	2	27
Peas	1	1	1	16	2	21
Beans	1	1	2	16	3	23
Soya	1	1	1	8	1	12
Eggplant	2	2	1	18	1	24
Pumpkin	1	2	2	10	1	16
Cotton	0	0	2	16	0	18
Millet	0	1	1	6	1	9
Onion	1	0	0	6	3	10
Garlic	1	0	0	2	1	4

The richness or richness of the mycobiota can also be noted as an indicator quality characterized as a relative concept and related to the conditions in which the study was conducted. For example, as it can be seen, 13 types of fungi species were found in onions in our research, but in the research conducted in forest-steppes of Obyan (Russia F), 31 types of fungi and fungus-like organisms were found in onions.

As mentioned, the fungi recorded in the cultivated plants in the Kura-Araz lowland are unevenly distributed on the substrates, that is, some of them can settle on the substrate of a specific species, some on the substrates of one or more genera, and some on any type of plant. In a number of mycological studies (Asadova and Aslanova, 2024), they also use the following 3 groups to characterize fungi in this aspect:

Stenotrophs: They live only on a specific substrate, that is, fungi with a specific substrate specificity belong to this group.

Conditional stenotrophs: Those belonging to this group have some sense of substrate specificity, but they are fungi that inhabit plants belonging to a specific genus or several species.

Eurytrophs: Fungi belonging to this group have no substrate specificity and can inhabit a large number of plant species.

It is clear from the research conducted on this distribution that this characteristic has some importance for a complete understanding of the role of fungi in the ecosystem, but the distribution

on substrates cannot be considered as characteristic features of fungi. Thus, it was determined that some fungi, which were found to be distributed only in a specific plant species under natural conditions, have the ability to absorb different substrates used when they are brought out to pure culture in laboratory conditions. For this reason, it was not considered appropriate to characterize the fungi recorded in the course of the research according to this division. However, it can be noted in general that stenotrophs, conditional stenotrophs, and eurytrophs are found among the fungi recorded in the Kura-Araz plain. For example, Peronospora brassicae, Plasmopara dauci, Uromyces pisi, etc. fungi such as stenotroph, Ascochyta hordei, Septoria cucurbitacearum, S.nodorum Puccinia allil, etc. conventional stenotroph, Alternaria alternata, Aspergillus flavu, Botrytis cinerea, Penicillium chrysogenum, Fusarium moniliforme, F.oxysporum, Verticillium dahliae, etc. and fungi such as are carriers of eurytrophs characteristics. By the way, there is no doubt that the vast majority of registered fungi belong to eurytrophs, which should be evaluated as a negative situation. So, mushrooms with this characteristic have almost no problems in meeting the demand for nutrients, and they have better positions in the struggle for survival.

It would be appropriate to touch on an issue related to the distribution of fungi recorded in cultivated plants in the Kura-Araz plain, that is, some issues related to the characterization of fungi according to areal classification.

CONCLUSION

During the characterization of the fungi recorded in mycological studies conducted in the world, as well as in Azerbaijan, the geographical elements of their distribution are also touched upon, and based on this, the model of areal classification proposed by botanists, more specifically, A.A. Grosgame for the Caucasian flora, refined by a number of authors. It should be noted that a number of fungi distributed in Azerbaijan were characterized based on this model and the results of all of them were somewhat similar. The essence of this similarity lies in the high influence of the northern factor in the formation of the mycobiota characteristic of the nature of Azerbaijan, and as a result of this, most of the mushrooms recorded in Azerbaijan belong to the boreal type. For example, 69.8% of the fungi recorded in the studies conducted in the Mughan Plain, 52.3% of the species participating in the formation of the mycobiota of agricultural plants cultivated in Absheron have the characteristics specific to the boreal type. The characteristic feature of this type is that it covers Europe, Asia and North America, the northern temperate climate zone of Europe and Asia, Northern Europe, as well as some southern regions of Europe, the steppe zone from Hungary to Northern Kazakhstan, and species located in the steppes of the North Caucasus.

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