

## The Characteristics of Mycobiota of Some Cultivated Plants by Species Composition and the Frequency of Occurrence in the Conditions of Azerbaijan

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In the presented work has been studied the mycobiota of various plants used for food and feed purpose in Azerbaijan. It was shown that in the formation of mycobiota of 19 species of studied plants involved 127 species of fungi, and of them 115 species belongs to fungi (Mycota), 12 species to the fungi-like organisms (Chromista). 38 species of the registered fungi can spread throughout the territory of Azerbaijan, and their frequency of occurrence varies from 3,4 to 54,3%. Among the fungi that are characterized by the distribution on the separate host plant, as well as by the different indicators to the frequency of occurrence are species (Botrytis cinerea, Erysiphe communis, Fuzarium oxysporum F.moniliforme, F.solani, Uromyces pisi, Verticillium dahliae and other) that cause dangerous diseases in cultivated plants. Results obtained in the course of research is important from the point of view to take preventive measures to limit the activity of phytopathogenic fungi in the future.

**Keywords:** Cultivated Plants; Ecological-Trophic Relations; Frequency of Occurrence; Mycobiota; Species Composition.

Plants are an irreplaceable source of nutrition for all living things, including for humans. Therefore, regardless of the purpose, obtaining a sufficient amount of plant products is one of the important tasks of the modern era<sup>12</sup>. As a logical result of this, both fundamental and practical research is being conducted in this area.

In studies conducted so far have been developed high-yielding plant sorts. At present, from them primarily obtain food and feed products, and in this way being made efforts to address food

shortages that are clearly felt in some parts of the world today. Despite this, some of the products obtained each year for various reasons are either directly lost or unusable for used<sup>11</sup>. There are various reasons for this. Among them are diseases caused by various organisms occupies an important place<sup>13</sup>, and it is no coincidence that extensive research is being conducted all over the world to prevent this<sup>5,14,16</sup>. It is considered an obvious reality that this issue can not be resolved by any specific country. Among this type of pathologies diseases

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caused by fungi are of particular importance. The first is because today, the specific weight of fungi is the highest among of all living things which causes various pathologies on plants<sup>1,19</sup>. Second, the loss of yield during the euphotia of disease caused by this or that fungus can be up to 100%<sup>8</sup>.

In order to prevent diseases caused by fungi is very important to thoroughly research them, to study their growth, and development, the laws of their spread, and to develop effective measures to control them.

In the Republic of Azerbaijan much attention is paid to the cultivation of agricultural crops, including food, feed, and medicinal plants<sup>9</sup>. For this reason, the above-mentioned issues are not new to our country, and the research conducting on their study confirms this<sup>17</sup>. Most of the research has covered the study of pathogenic fungi that cause disease in fruit trees and trees species that form the main forest<sup>6</sup>, as well as in medicinal plants<sup>3</sup>. Despite this, was not found the systematic study of mycobiota of plants widely grown in Azerbaijan for food and feed purpose.

Therefore, in the presented work, was set as the goal study mycobiota of some plants grown in Azerbaijan for food and fodder purpose by species composition, frequency of occurrence and ecological-trophic relations

## MATERIALS AND METHODS

To achieve the set a goal, in 2015-2019 were taken samples from vegetative and generative organs of some plants (19 species) grown in economic regions of Azerbaijan such as Absheron, Aran, Ganja-Gazakh, Guba-Khachmaz, Lankaran, and Zagatala-Sheki, which was supposed to be fungi, and was analyzed in accordance with the set goal. For the taking samples were used both from planned route method(widely used in the course of mycological research), and from the methods of selection of permanent areas for stationary observations[4, 18]. Sampling was also carried out by seasons. During the study was taken, and analyzed about 1000 samples. During sampling were taken samples from plants belonging to the same species(more precisely, from the same variety belonging to the species) but grown in different areas.

For the taking fungi to the pure cultures were used from standard mediums (malt juice, rice agar, starch agar, potato agar, and Czapek's agar) which their preparation was carried out in accordance with the relevant methods used in mycological research<sup>7</sup>. The samples, which were likely to contain fungi, were transferred to a nutrient medium, and placed in a thermostat (260C) for a period of time (up to 10 days), and stored until the colony was formed. After the formation of a colony or a pile of mycelium, due to the visual purity, they were transferred to a pure medium again, and this process continued until a clean culture was obtained. The purity of culture was controlled by a microscope. During the whole process were noted the date of formation of the colony, form, color, color of the backside, odor, form of mycelium, formation of conidia, and other derivatives, and their shapes, sizes, etc., and the identification of fungi was carried out mainly by the determinants<sup>10, 17</sup> compiled on the basis of cultural-morphological and biological features.

The frequency of occurrence of fungi was calculated according to the following formula:

$$P = (n/N) \times 100$$

Here, P – the frequency of occurrence, n – the number of recorded fungi, N -the number of samples.

## RESULTS AND DISCUSSION

From the result of the analysis of samples taken from some cultivated plants grown in the territory of the above-mentioned economic regions of Azerbaijan, it was determined that the number of species of fungi, and fungal-like organisms spread in the 19 plants studied is 127. Data on their number, reflecting their taxonomic structure, are given in Table 1. As seen, 90,5% of the registered fungi belong to the true (Mycota) and 9,5% to the fungi-like (Chromista) organisms.

Among the recorded fungi by the most common species are represented genus such as *Aspergillus* (8 species), *Fusarium* (8 species), *Penicillium*(10 species), *Puccinia* (9 species) and *Septoria*(8 species). The number of species of other genres involved in the formation of the mycobiota of the studied plants varies between 1 to 6.

**Table 1.** Numerical characteristic of the taxonomic structure of fungi recorded in studies

Kingdom	Division	Class	Order	Family	Genus	Species
Chromista	1	1	1	2	5	12
Fungi (or Mycota)	3	6	9	15	50	115
Total	4	7	10	17	55	127

**Table 2.** The spread of fungi on the studied plants

Plants	Taxonomic relations of mushroom species						Total
	Chro-mista Oom-ycota	Chytridio- mycota	Zygo- mycota	Fungi		Bazidio- mycota	
				Ascomycota Teleomorph	Anamorph		
Triticum durum Desf	0	-	0	2	11	3	16
Hordeum vulgare L.	0	-	0	1	10	2	13
Zea mays L.	0	-	1	2	8	3	14
Solanum tuberosum L.	1	-	0	0	7	1	9
Solanum lycopersicum L.	3	-	2	2	14	2	23
Brassica oleracea L.	1	1	0	0	5	1	8
Daucus carota L.	1	-	1	2	5	2	11
Solanum melongena L.	2	-	2	0	12	2	18
Capsicum L.	1	-	-	1	12	1	15
Cucumis sativus L.	2	-	0	1	7	1	11
Citrullus lanatus (Thunb.) Matsumura & Nakai	1	-	2	2	12	1	18
Cucumis melo L.	2	-	1	2	15	2	22
Cucurbita pepo L.	1	-	2	2	12	2	19
Helianthus annuus L.	1	-	1	3	12	2	19
Pisum sativum L.	2	-	0	2	14	2	20
Phaseolus vulgaris L.	1	-	0	1	12	3	17
Glycine max L.	1	-	0	0	7	1	8
Medicago sativa L.	1	-	1	4	18	3	27
Beta vulgaris L.	2	-	1	3	10	2	18
Total	12	1	7	24	57	26	127

During determining the share participation of fungi in the formation of mycobiota of individual plants became clear that *M. sativa* plant is characterized by richer mycobiota (Table 2). Thus, fungi included in the mycobiota of this plant makes up 21.3% of the total registered species, ie this plant is a more “delicious” food source for fungi, as well as their pathogenic representatives. The mycobiota of tomatoes and melon can also be considered rich, because, their share in the total mycobiota is 18.1%, and 17.3%. The soybeans are characterized by scanty(6.3%) mycobiota, the reason for this is due to the few cultivations of this plant in Azerbaijan, as well as the fact that its cultivation period short. Which species represented by the most species

was mentioned above. As seen from table 2, the distribution of true fungi (Mycota) by separate divisions is also different, and most of the fungi belonging to sack fungi (Ascomycota) (63.8% of the total microbiota). Basidiomycetes takes part 20.5%, zygomycetes 5.5%, chytridiomycetes 0.8% in the total amount of mycobiota.

It should be noted that in researchs have been found both anamorphs, and teleomorph of sack fungi. Thus, were determined that 70.4% of the registered fungi belong to the anamorphs (44.9% of the total mycobiota), and 29.6% to the teleomorph (18.9%) of sack fungi.

The frequency of occurrence is considered one of the important indicators for clarifying the

functions performed by fungi in one or another cenosis<sup>2</sup>. For this reason, in the course of research its determination was also considered expedient.

Of the fungi recorded during the study, only 38 species (*Alternaria alternata*, *A. radicina*, *A. solani*, *Ascochyta cucumeris*, *Asc. lycopersici*, *Asc. pisi*, *Asc. trifolii*, *Aspergillus fumigatus*, *A. niger*, *Blumeria graminis*, *Botrytis cinerea*, *Cladosporium herbarum*, *Colletotrichum trifolii*, *Erysiphe communis*, *Fusarium oxysporum*, *F. moniliforme*, *F. solani*, *Mucor mucedo*, *M. racemosus*, *Penicillium martensii*, *P. chrysogenum*, *P. notatum*, *Phoma destructiva*, *Phytophthora infestans*, *Pythium debarianum*, *Rhizopus nigricans*, *Rhizoctonia solani*, *Sclerotinia libertiana*, *Septoria cucurbitacearum*, *S. glycines*, *S. lycopersici*, *S. nodorum*, *Trichoderma viride*, *Trichothecium roseum*, *Uromyces pisi*, *U. trifolii-repentis*, *Verticillium dahliae* and *V. lycopersici*) were spread in all research areas of Azerbaijan, of which 5.3% belong to the division of Oomycota, 7.9% to Zygomycota, 7.9% to Basidiomycota, and the rest (78.9%) to Ascomycota. The frequency of occurrence of these fungi in the studied areas varies between 7.8-54.7%.

According to some researchers a frequency of occurrence if 40-50% or higher is considered to be the dominant species, between 10 and 40% is considered to be the most common, and less than 10% is considered to be a random or rare species for studied biotope<sup>3</sup>. Given that this idea more accurately characterizes the distribution of fungi in the biotope, the use it in this study was also considered expedient. Accordingly, only 5 species of fungi registered in the course of research and included in the mycobiota of studied plants – *A. niger* – 54.3%, *B. cinerea* – 41.3%, *F. oxysporum* – 41.6%, *P. martensii* – 43.5% and *V. dahliae* – 44.7%, can be considered dominant.

17 species of registered fungi can be characterized as often encountered species which, is made possible by their frequency of occurrence: *Alternaria alternata* – 19.3%, *A. radicina* – 16.7%, *A. solani* – 31.7%, *Asc. lycopersici* – 15.4%, *A. fumigatus* – 24.5%, *Cladosporium herbarum* – 16.7%, *F. moniliforme* – 29.8%, *F. solani* – 14.3%, *M. mucedo* – 21.4%, *M. racemosus* – 18.2%, *P. chrysogenum* – 30.6%, *P. notatum* – 23.7%, *Phoma destructiva* – 14.8%, *Rh. nigricans* – 22.9%,

*T. viride* – 32.4%, *U. pisi* – 15.8% and *V. lycopersici* – 23.5%.

The number of random species is 16 and their frequency of occurrence is characterized as follows: *Ascochyta cucumeris* – 7.9%, *Asc. pisi* – 8.6%, *Asc. trifolii* – 8.7%, *Blumeria graminis* – 5.3%, *Colletotrichum trifolii* – 5.1%, *Erysiphe communis* – 6.1%, *Phytophthora infestans* – 8.6%, *Pythium debarianum* – 5.8%, *Rhizoctonia solani* – 3.6%, *Scl. libertiana* – 8.9%, *Septoria cucurbitacearum* – 6.3%, *S. glycines* – 8.4%, *S. lycopersici* – 5.4%, *S. nodorum* – 3.4%, *Trichothecium roseum* – 4.5% and *U. trifolii-repentis* – 9.3%.

It should be noted that only 38 of the 127 species recorded in the course of the study were found in all areas where the studied plants were grown. Among this fungi are dangerous phytopathogens such as *Asc. lycopersici* (ascochytosis), *A. alternata* (alternariosis), *B. cinerea* (gray rot), *Erysiphe communis* (flour dew), *F. moniliforme* (fuzarioz), *F. oxysporum* (fuzarioz), *F. solani* (fuzarioz), *Phoma destructiva* (fomosis), *Ph. infestans* (phytophthora), *V. dahliae* (fading), *V. lycopersici*, *U. pisi* (rust), and others. Besides, there were registered other pathogens that, not found in all areas. As an example of this can show fungi such as *Erysiphe cichoracearum*, *Fusarium gibbosum*, *Olpidium brassicae*, *Puccinia recondita*, *Sclerotinia sclerotiorum*, *Uromyces pisi*, and others. According to the date of literature, as a result of diseases caused by these fungi, the productivity of host plants can be reduced by 10-50%. This is an undesirable crop loss in the current situation. Although their frequency of occurrence is characterized by a specific indicator (12-28%) of frequently encountered species in different economic regions (12-28%), today their frequency of occurrence in Azerbaijan is characterized as random species (0.02-5.7%). Although this indicator allows us to note that the general phytosanitary situation in the country is not dangerous yet, taking preventive measures to limit the activity of phytopathogenic fungi should be considered a necessary condition today.

## CONCLUSIONS

Thus, from the carried out of research determined that in the formation of mycobiota

of 19 plant species cultivated in Azerbaijan for food, feed, and medicinal purpose involved 127 species of fungi, of which 90.5% belongs to the true fungi (Mycota or Fungi), 9.5% to the fungi-like organisms. Only 38 species of the registered fungi, can spread in all areas where the studied plants were grown. Among the fungi that are characterized by different indicators both in their distribution on individual host plants, and the frequency of occurrence are also species which cause dangerous diseases in plants. Results obtained in the course of research along with creating a certain impression about the mycobiota of plants grown in Azerbaijan is also important from taking preventive measures in this direction in the future.

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