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Comparatıve Study Of Mycobıota Of Some Relıct Plants Included To The Flora Of Azerbaıjan

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ABSTRACT

The aim of the presented article is to carry out the comparative analysis of some relict trees included to the flora of Azerbaijan with regards to species composition of their mycobiota, eco-trophic relations and spread degree of pathologies they cause as well as interrelations between them. It became clear that generally fungus species present in the formation of mycobiota of relict plants which is low rather than other tree plants. Insufficiency of mycobiota, which results in relative low number of pathologies in compare with other trees give opportunity to highlight greater possibilities of use of relict plants in different purposes, initially in landscaping of the urbanized territories. Participation of fungi damaging seriously the plants by causing dangerous diseases in the formation of mycobiota in a low number, antogonist relation of some fungi with spread ability in the relict plants against phytopathogens can be considered as one of the causes for coming of these plants from the remote past up to now.

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INTRODUCTION

As it is clear geographical position, natural climate condition of the Republic of Azerbaijan, its rich and colorful nature make it important to carry out various, that is botanical, zoological, mycological and other studies in its territory. About 4700 plant species [5] of higher plants belonging to 125 families and 930 genera which differ from each other for their life forms, decorative appearance, significance and other properties are distributed in Azerbaijan where nine out of twelve climate zones are observed.

Trees, shrubs and grasses can be found among the plants belonging to the flora of Azerbaijan. There are enough plants with fodder and medicinal significance, as well as those used for technical purposes. At the same time, there are endemic and relict species in the flora of Azerbaijan[1]. The latters, that is considered to be relict plants, more precisely those in the form of trees and shrubs are represented with species such as Persian Silk Tree –Albizzia julibrissin Durazz., fig- Ficus carica L., pomegranate - Punica granatum L., Caspian locust - Gleditsia caspica L., iron tree- Parrotia persika C.A.M., plane- Platanum orientalis L., chestnut-leaved oak - Quercus castaneifolia L.and etc. in the flora of Azerbaijan. From time to time such diversity has made the nature of Azerbaijan the object of studies with various aspects (botanical, mycological, phytopathological, etc.)[1, 12]. Nevertheless, if we analyze the results of our studies, particularly with mycological characteristics, we can see that there are many problems to be solved in this area. Among them comprehensive study of mycobiota of relict plants, especially their pathogen species are also important issues.

Generally it should be noted that coming of relict plants which existed up to the third arctic flora from Great Ice Age to date is one of the issues of great scientific interest. Therefore presently several researchers try to determine the reason of remaning of relict plants, representatives of flora of the third period up to modern period [16]. Thus investigation of adaptation ways of representatives of Azerbaijan flora existed up to the third arctic flora to the changed climate condition, as well as their protecion are of both scientific-theoretical and practical interest. In studies conducted on relict plants, the resistance of these plants to the effects of various living organisms, as well as fungi, didn't take place among the causes of these problems, although that fungi causes different pathologies in plants, decrease their biological activity and even results in their mass death [3, 7]. In addition fungi are able to synthesize various phytohormones which besides their stimulating affect to plants can provide additional advantages in their struggle for life [11, 15,]. In our opinion the investigation of this issue can also give certain arguments for the clarification of resistance indicators of relict plants.

Hence the aim of the presented work has been devoted to conduct the comparative assessment of some relict plants (trees) from the flora of Azerbaijan on species composition of mycobiota, eco-trophic relations and spread degree of caused pathologies as well as interrelationships between them.

MATERIAL AND METHODS

As an object to conduct mycological studies in trees like Albizzia julibrissin., Ficus carica, Gleditsia caspica, Parrotia persika, Platanum orientalis and Quercus castaneifolia growing[6] in various places of Azerbaijan (Kura-Araz lowland, Greater Caucasus, Talysh Mountains, etc.) were selected and samples were taken from vegetative and generative organs where presence of fungi is assumed. Samples were taken from places where plant species mostly grow as a group. For comparison purposes Ordinary Hornbeam (*Carpinus betulus L*), Caucasian lime (*Tilia caucasica Rupr*) growing in natural and artificial forests of the Republic of Azerbaijan and Oriental beech (*Faqus orientalis L*) widely applied in greening of Azerbaijan were used. In the course of mycological researches planned route method which is widely applied in sampling were used. Sampling were also conducted on seasons and generally about 1000 samples were taken during 2012-2019. Taken samples were passported in place and prepared for the laboratory analysis.

For transferring fungi to pure culture agarized malty juice (AMJ), rice agar (RA), starch agar (SA) and potato agar (PA), agarized Czapek and Czapek Dox media were used as nutritional medium. Preparation, sterilaztion of medium and pouring to Petri dishes were done according to the known methods [5, 10]. Sample with assumed fungi is transferred to nutritional medium and placed in thermostat (26^{0}C) for certain period (up to 10 days) and kept there until colony is formed. After colony and micelle stock are formed and visual purity is checked they are re-planted in the pure medium and this process continued untill clean culture is obtained. The purity of the culture is controlled by a microscope. During the whole process microscopic images of colony formation date, shape, color, background color, odor, as well as microstructural elements of the colony (shapes, sizes of micelles, conidium and other derivatives and etc.) are recorded. Identification of those transferred to pure culture as well as pathologies caused by fungi has been carried out based on current determinants[8, 13-14].

During the study of relations between fungi their separate plantation is implemented for 7 days in a deep plantation condition (200 times[vr/min) in Czapek's medium. Biomass of fungi growing in the same nutrient medium as inoculum was used and the same quantity (1ml) was added to each flask (250ml Erlenmeyer flask). During the companion plantation of fungi, the added inoculum was the same amount (i.e., 0.5 + 0.5). The amount of biomass obtained at the end of the plantation is determined by constant weight at 105^{0}C.

When clarifying the relationship between plants and fungi, extracts from all materials, mix of all vegetative and generative organs of each plant are obtained, 10% extract from plant material which is prepared for 2 hours, in 40^{o}C with distilled water was used in this process. 1% from the obtained extract was added to Czapek's medium instead of the carbon source. The cultivation was conducted under the same conditions and assessment was carried out for the constant weight of the biomass.

The frequency of occurrence on samples taken from fungi as well as the spread degree of diseases caused by pathogenic cultures are determined by the following formula: $P = (n/N) \times 100$

Here N- frequency of occurrence of fungi on samples (or spread degree of disease caused by pathogen-with %), n-number of discovered fugi (number of infected plant individuals in the studied area, in numbers), N- total number of samples (total number of plant species in the studied area).

Experiments were repeated at least 5 times during the course of the study, and the results obtained were statistically processed [6].

RESULTS AND DISCUSSION

As a result of the studies conducted during 2012-2019 it became clear that generally 96 fungi species present in the formation of mycobiota of relict plants belonging to the natural flora of Azerbaijan and other trees used for the comparison. Table 1 shows their spread on separate tree genera. As to taxonomic relation of the mentioned fungi, 60 species out of them belong to Ascomycota, 32 species to Bazidiomycota, and 4 species to Zygomycota divisons. As to distribution of fungi on separate plants species as seen, from relict plants *A.julibrissin* is characterized with the poorest, *Q.castaneifolia* with the richest mycobiota. When we compared species number of mycobiota of relict plants with plants taken as a control it became clear that in all cases the number of fungus species settled in relict plants is relatively low and this difference is 1,1-2,4 times. It is worth noting that 71 species out of noted 96 are encountered in the studied relict trees, 84 in trees used as a control.

Based on these differences, it can be noted that this fact may also have a role in the sustainability of relict plants. Thus, there are different relationships between fungi and plants, some main point lies in the fact that fungi use plants as food sources. As a result, the productivity of this plant decreases, weakens, and even sometimes loses its vitality[10]. In this regard, presentation of fungi in the formation of mycobiota of relict plants with small number can be considered as a case that significantly reduces occurring likelihood of these adverse cases.

We must touch one point with regards to the given in the table which is connected with eco-trophic distribution of fungi that present in the formation of mycobiota of the noted plants. More precisely, fungi are different from each other in terms of eco-trophic relationships and receive organic matter neseccary for nutrition either at the expense of living or weakened or plant materials with lost vitality. In this regard clarification of specific weight of biotroph, as well as politroph (facultative biotroph+ facultative saprotroph) fungi in general mycobiota is one of the main important issues.

Considering this, distribution of fungi recorded in studies on separate trees is also clarified. It became clear that in general the number of noted fungi which belong to biotrophs in terms of eco-trophic relations, that is distribution is noted only in living trees, is 7 (*Cronartium quercus (Brond.) Arth., Cronartum sp., Fomes fomentarius, E.coomunis, Microsphaera alphitoides, Phellinus igniarus, Taphrina sp.*), of which only 4 are observed in relict plants, 5 in plants used as a control. This fact is also important for the approval of the above mentioned statement.

In the distribution of fungi in terms of eco-trophic relationships none of belonging to biotrophs is universal, as F. fomentarius has the ability of distribution in all (both relicts and control) trees except acacia and figs, and others which are agent of powdery mildew and rust diseases only in their own host plants.

It should be noted that there are certain relationships between fungi each other, as well as with the host plants, which are sometimes characterized by antioxonism, sometimes neutralism, and sometimes stimulation. Besides the result of interrelations of other fungi with plants reveals itself in a form of various pathologies. In the end of these relations certain changes take place in the vital activity of one or both parts in the relationship. Depending on the nature of this change life activity of partnor livings either strengthen or weakens. Not depending on which side these processes takes place the same living gain advantages towards progressive or regressive direction in its struggle for life. For instance, antagonism between fungi belonging to genera Trichoderma and Fusarium genes[2], synthesizing phytohormones by some phytopathogenic fungi[11,15] and other such cases may be an example.

Description of numbers of fungi presenting in the formation of mycobiota of the studied plants from this aspect may be important in terms of the clarification of the answer to the question sought in the presented work, that is the reasons of sustainability of relict plants. Therefore it is considered appropriate to clarify this issue in the course of researches as well. In this regard studies were carried out in respect of the relationships with each other of cultures of species included to the mycobiota of the studied plants which are possible to transfer to the pure culture, as well as the effect of materials obtained from plants to their growth. Based on the results obtained in the course of the research, the following generalized statements can be noted:

1. Fungi causing diseases as rust, powdery mildew, white and brown rot, cancer, various colored spot, Ascochyta spot, Septoria spot, wilt, fusariosis, cladosporiosis, necrosis and etc. present in the formation of mycobiota of both relict plants and plants used as a control. But, their spread degree generally varies between maximum 0.2-9.8% in relict plants, 3.4-15.1% in control plants and 56.7% in pagoda tree.
2. There are antagonistic relationships between the individual species involved in the formation of the mycobiota of relict plants, so when their cultures which were transferred to pure culture are planted together weakening can be observed in their both growth. Thus during companion plantation of cultures belonging to individual species, the amount of biomass they form when planted separately under the same condition is 17-32% lower than biomass formed during companion plantation. But it is contrary in plants used as a control; in the worst case, neutral relationships are observed between cultures transferred to the pure culture. Weakenings are observed although rare, but their quantitative index is less than 10% in all cases.

3. There are also some differences in the relationships between plants found with fungi. The difference lies in the fact that extracts from relict plants slow the growth of fungi, and a quantitative index of this weakening reaches maximum 20% as per the amount of biomass. Similar conditions are not clearly observed when using extracts from trees used as controls.

Relying upon these statements and observed relationships between relict plants and fungi it will be logical to consider these as causes of their coming till now.

CONCLUSION

Thus, as a result of researches conducted it became clear that 86 species belonging to different taxonomic groups of fungi present in the formation of mycobiota of some relict trees included to the flora of Azerbaijan and they have ability to cause various pathologies in these plants. Despite of this it also becomes visible from the researces that relict plants differ from other tree plants for species composition of mycobiota, eco-trophic relations and the extent of spread of the pathologies they cause, as well as form of interrelations between them. Participation of fungi damaging seriously the plants by causing dangerous diseases in the formation of mycobiota in a low number, antogonist relation of some fungi with spread ability in the relict plants against phytopathogens can be considered as one of the causes for coming of these plants from the remote past up to now.

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Table 1 :Distribution of fungi recorded in studies on individual plants

№	Plant species	Number of fungi species			Total
		Zygomycota	Ascomycota	Bazidiomycota	
1	*A.julibrissin*	1	14	7	22
2	*F.carica*	2	22	11	35
3	*G.caspica*	1	12	15	28
4	*P.persika*	2	17	12	31
5	*P.orientalis*	1	16	12	29
6	*Q.castaneifolia*	1	20	19	40
7	*C.betulus*	1	21	25	47
8	*T.caucasica*	2	23	20	45
9	*S.japonica*	3	40	9	52
Total		4	60	32	96