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Research Article

SPECIES COMPOSITION AND ROTTEN DISEASES OF TREE SPECIES IN SUBTROPICAL FORESTS OF AZERBAIJAN

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ABSTRACT

Objectives Annotation. From the carried out of research in the subtropical forests of Azerbaijan were found 60 species of xylophilic basidiomycetes, among which about 20 species cause rotten diseases in living trees. 75% of diseases were found in the trunks, and 25% in the roots of tree species. However, the prevalence rate of these types of diseases is characterized by different quantities. So, the rotting diseases caused by the mushrooms *Fomes fomentarius*, *Ganoderma applanatum* and *Fomitopsis pinicola* are the most dangerous according to the degree of spread quantitative indicators of which are 5-7%. The degree of rotten diseases caused by other fungi constitute less than 1%, even some are characterized by single finds.

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INTRODUCTION

It is known that the forest is certain natural unity, where all the vegetation, fauna and microorganisms, soil and atmosphere are in close interaction and interdependence [5], from which it should be asserted that fungi are one of the natural components of the forest community, and a powerful factor affecting the life of the forest as a whole. From their activities depends, to a certain extent, formation of a full-fledged forest as a natural as an artificial (created by man) [18].

Fungi don't have chlorophyll and in this connection they are not able to synthesize organic substances for that they are forced to use ready organics. Needing a ready organic substance all fungi find it either in the living organism of plants and animals parasitizing on them or developing in a variety of organic substances of animal and vegetable origin [2].

A living plant serving as a place of settlement and a source of food for fungi is called a host plant but the fungus called parasite. Unlike parasites saprotrophs live at the expense of dead organics of plant and animal origin. Plants, plant and animal remains and other material used by fungi for settlement and nutrition, is called a substrate. The nutrition of fungi is very different and it is associated with a set of their existing enzymes. The conducted researches have shown that fungi have a perfect enzymatic apparatus which allowing them to

fully use organic residues. An exceptionally large set of narrowly specialized enzymes allows fungi to lead respectively either biotrophic or saprotrophic lifestyle [10-11].

Fungi perform wide and diverse functions in various ecosystems, including forests one of which is the infection in the forest of trees with various diseases [13, 17-18]. A particularly important role in the life of the forest belongs to the higher fungi in particular xylophilic [15]. Developing on living tree species, xylophilic cause huge damage forestry: destroys the wood, weakens the root system. The result of these is premature desiccation of trees. Is interesting the fact that many of xylophilic begin their development on the living tree and continue to develop after it death; lives on harvested wood and thereby destroying it and completely devalue [1-2, 11].

Comparatively on the small territory of Azerbaijan can see all kinds of relief (the mountains, lowlands, plains and etc.) [7]. About half of the territory of Azerbaijan is occupied by mountains: in the north - the ridge of the Greater Caucasus, in the south-west - the ridge Small Caucasus. The territory of the Republic of Azerbaijan also has a rich flora. Here, spread over 4,700 species of flowering plants some of are rare and endangered. In the territory of Azerbaijan, exists broad-leaved forests, mixed forests, tugai forests, plantations of evergreen plants, subalpine woodlands, alpine meadows (in the mountains) [12].

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Although Azerbaijan does not belong to the region with rich forests, however, at the present the total area of Azerbaijani forests is 1021 hectares. This amounts to 11.8% of the territory of Azerbaijan [7]. The forests of Azerbaijan are very rich. On their territory survived even unique forests - a monument of the Cenozoic era. They are not found, anywhere in the world. Therefore It is not surprising that the government constructs and contains many of its protected nature areas. Reserves (Now national parks) as the Kizilakach, Zakhatal and Shirvan have international significance. Hirkan Reserve protects the relict plant in the Talish Mountains and the Lenkoran Lowland.

Many forest tracts in Azerbaijan which, as a rule, prohibited intensive farming to a large extent are infected with fungal diseases, striking trunks, branches and roots on the growing plants []. However, their detailed investigation is still unresolved, is open for studies of mycological and phytopathological nature, which was the purpose of the presented work.

MATERIALS AND METHODS

Studies were conducted in natural (in forests located in the Talysh mountains) and artificial (Central Botanical Garden of Azerbaijan National Academy of Sciences) forests. During the route research and stationary observations by us were conducted the sampling of roots and trunks of the main forest-forming trees species (oak, hornbeam, beech, linden, iron tree, etc.) of the Azerbaijan forests. In addition, was gathered fruit bodies (basidioma), cut from living trees (trunks, branches, root part). Preparations for microscopy were prepared in aqueous solution with 5% KOH. In case of need for coloring preparation were used the Meltzer reagent and aniline blue [2]. For identify the species of xylotrophic macromycetes and also the type of rot caused by them were used various determinants [3, 6, 8, 11, 16, 17], compiled on the basis of macro- and micro-signs.

THE RESULTS AND DISCUSSION

Originally was investigated the main forest-forming tree species of the forests of Azerbaijan in the direction of revealing the species composition of xylotrophic macromycetes. At the result of the studies were identified 60 species, which taxonomic structure is presented in table 1, according to the system which was used on the official website of the International Mycological Association. The genus *Phellinus* which are represented by 10 species, and also the genus *Fomitopsis* and *Inonotus*, numbering 7 species were characterized by a predominance in the isolated mycobiota of the investigated trees species.

Table 1 Taxonomic structure of xylotrophic macromycetes found in the main forest-forming species of the Azerbaijan forests.

Division	Classes	Order	Family	Genus (Number of species)
Bazidio-mycota	Agaricomycetes	Polyporales	Polyporaceae	Fomes(1), Fomitopsis(7), Panus(1), Polyporus(2) Cerrena(1) Hirschioporus(1) Lentinus(2) Trametes(3), Pycnoporus(1), Tyromyces(1)

				Pseudotrametes(1)
			Meruliaceae	Rigidoporus(1), Heteroporus(1) Laetiporus(1),
			Fomitopsidaceae	Piptoporus(1) Daedalea(1)
			Ganodermataceae	Ganoderma(3)
	Hymenochaetales		Hymenochaetaeaceae	Phellinus(10), Inonotus(7)
			Schizoporaceae	Oxyporus(1)
			Pleurotaceae	Pleurotus(2)
			Schizophyllaceae	Schizophyllum(1)
	Agaricales		Physalacriaceae	Armillaria(1), Flammulina(1)
			Pluteaceae	Pluteus (1)
			Fistulinaceae	Fistulina (1)
			Inocybaceae	Crepidotus(1)
	Russulales		Stereaceae	Stereum(2)
			Peniophoraceae	Peniophora(2)
	Gloeophyllales		Gloeophyllaceae	Gloeophyllum(1)
1	1	5	15	30

It should be noted that identified species in the studied tree species are differed among themselves for different indicators: As known, xylotrophic fungi cause various pathologies in tree species and all this is called rotten disease [11], which was the object of the following stages conducted research by us. Rotting diseases infect trunks, branches and roots of tree species and are characterized by the destruction of wood, accompanied by a change in its mechanical, physical and chemical properties. As noted, xylotrophic fungi cause rot of wood which among prevail species able to develop both in living and in dead tissues, to move from living, growing trees to dead and vice versa. Observations showed that rot pathogens penetrate into the tissues of the tree through various damages (scrapes, cancer wounds, as well as through cuts or bumps of branches) trunks, branches and roots. During the research were found the following types of rot, which differed in location on the parts of the tree: Root, inboard (up to 2 m in height of the trunk), stem, including cross-cutting (along the entire length of the trunk), vertex, rot of branches. According to the location of rot in the roots, trunks or branches their are divided on the nucleus, sapwood and mixed. Rot on the nucleus occurs and develop in the nucleus part on the influenced organs and spread to the sapwood. Sapwood rot is located in the outer part of the roots, trunks, branches and spread to their center. Mixed rot is characterized by uneven dissemination on the trunk therefore, along with the affected central parts the trunk can be uninjured, external. During the research, the identified fungi caused the following types of rotting diseases:

Root Rot

The motley pit-fiber (sieve) rot of roots which caused by fungi *Heterobasidion annosum* (Fr.) Bref. The host-plant of this fungus is many species of Conifers (pine, spruce, juniper and cedar) and in more rare cases - some deciduous, including alder, aspen.

White sapwood rot of coniferous roots and deciduous species, the pathogenic fungi is an *Armillaria mellea* (Vahl) P. Kumm. According to the literature, the fungus infects more than 200 species of woody plants[11], in the course of our research signs of rotten diseases caused by this fungus were found in oak, hornbeam, beech and linden. Brown nucleus root and coniferous rot of coniferous species which is caused by the

fungus *Phaeolus schweinitzii* (Fr.) Pat. During the research this type of rotting disease was found on oak and pine.

White fibrous rot of root which is caused by the fungus *Inonotus dryadeus* (Pers.) Murrill. In the course of research this type of rot was found only near oak.

White nucleus-sapwood of the root and inboard rot of deciduous species. This type of rot disease is caused by the fungi *Ganoderma applanatum* (Pers.) Pat is one of the most widespread fungi in the forests of Azerbaijan[14]. During the research, the fungus was found only on deciduous species such as oak, hornbeam, linden, beech, alder and others. Is interesting the fact that this fungi meets both in natural and in artificial forests.

Stem Rot

1. Motley nucleus rot, the pathogen is the fungus *Phellinus pini* (Brot.) A. Ames. The host plant of this fungus is the Eldar pine.
2. Brown nucleus rot, is caused by the fungi *Fomitopsis officinalis* (Batsch) Bondartsev & Singer. During the research this type of rot was found in cedar, oak and pine.
3. Light brown nucleus-sapwood rot. These diseases were found both on deciduous (oak, hornbeam, poplar, beech, alder, linden, etc.), and on coniferous (pine, cedar, juniper) plants, exciter is the fungi *Fomitopsis pinicola* (Sw.) P. Karst. It should be noted that this fungus is also widespread in Azerbaijan[14], more precisely in the dominant nucleus of xylomycobiota of the Azerbaijan forests emerges.
4. Yellowish-white rot of nucleus, in the course of research was found in oak. The exciter of this pathology is fungus *Phellinus robustus* (P. Karst.) Bourdot & Galzin.
5. Motley nucleus rot. This type of disease in the course of research also was found on oak, but this time exciter of this pathology was the fungus *Inonotus dryophilus* (Berk.) Murrill.
6. Dark-brown root rot is caused by fungus *Daedalea quercina* (L.) Pers. This time, the host plant is oak.
7. Red-brown prismatic nucleus rot. This type of disease is caused by the fungus *Laetiporus sulphureus* (Bull.) Murrill. This time, as the host plant stands oak, hornbeam, gladichia, beech and linden. In the course of research, this fungus was not found on coniferous tree species.
8. White striped nucleus rot. The excite of this pathology is the fungus *Phellinus igniarius* (L.) Quél, which has a wide substrate (mainly deciduous breeds) list.
9. White striped nucleus rot of trunks which in the course of research was discovered on aspen. These pathologies are caused by the fungus *Phellinus tremulae* (Bondartsev) Bondartsev & P.N. Borisov.
10. White marble nucleus-sapwood rot, in the course of research was found on all deciduous species distributed in the forests of Azerbaijan and the exciter of this type of pathology is *Fomes fomentarius* (L.) Fr. In general, this fungus includ in the dominant nucleus of xylomycobiota inherent in the Azerbaijani forests[14].
11. Yellowish-white nucleus rot of trunks, was found mainly on hardwoods (oak, ligature, lime, poplar, etc.). The excitiv of this disease is the fungus *Oxyporus populinus*.
12. Yellowish-white nucleus rot of stem, in the course of research was found only on deciduous species (mulberry, ligature, Japanese Sophora, etc.) is caused by the fungus *Inonotus hispidus* (Bull.) P. Karst. This type of rotting diseases is widespread in artificial forests (an average of at least 3-4 cases per 1 ha of forest area), but in natural forests the extent of this type of disease is very low (0.2-0.3 cases per 1 ha).
13. White wound nucleus rot. The excitiv is *Polyporus squamosus* (Huds.) Fr., in the course of research it was determined that as the host plant were oak, linden, willow, poplar, ash and others hardwoods. Despite the fact that the fungus is phytopathogenic, it is also edible.
14. Reddish brown nucleus-sapwood rot. During the research this type of pathology was found only once on the birch and the excitiv of this disease is the fungus *Piptoporus betulinus* (Bull.) P. Karst.
15. Motley nucleus rot was found on oak, elm, poplar and other hardwoods. It is the first finding disease in the conditions of Azerbaijan as The excitiv of this disease the fungi *Spongipellis litschaueri* Lohwag has not been found in the studies so far, and Azerbaijani forests are a new area for this fungus. It should be noted that defeat of oak by fungus leads to an almost complete loss of wood, although this fungus and the disease caused by it is not widespread in the Azerbaijan conditions.

Thus, in the studies conducted in the Azerbaijan conditions, were found about 20 types of rotting diseases, which of 75% were found in trunks, 25% in the roots of tree species. However, the prevalence of these types of diseases is characterized by different values. So, the rotting diseases caused by fungi *Fomentarius*, *Ganoderma applanatum* and *Fomitopsis pinicola* are the most dangerous by degree of spread whose quantitative indicators are 5-7%. The degree of spread of rotting diseases, caused by other fungi are less, than 1%, even some are characterized by single finds.

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