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## BIOECOLOGICAL CHARACTERISTICS, DISTRIBUTION, AND PHYTOPATHOLOGICAL SIGNIFICANCE OF WOOD-DECAYING MACROMYCETES IN THE NAKHCHEVAN AUTONOMOUS REPUBLIC

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## БИОЭКОЛОГИЧЕСКИЕ ХАРАКТЕРИСТИКИ, РАСПРОСТРАНЕНИЕ И ФИТОПАТОЛОГИЧЕСКОЕ ЗНАЧЕНИЕ ДРЕВЕСНОРАЗРУШАЮЩИХ МАКРОМИЦЕТОВ В НАХЧЫВАНСКОЙ АВТОНОМНОЙ РЕСПУБЛИКЕ

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*Abstract.* The Nakhchivan Autonomous Republic is distinguished by its rich flora and diverse ecological conditions. Wood-decaying macromycetes occurring in this region exert a significant impact on the stability of forest and park ecosystems. They mainly belong to the class Basidiomycetes, parasitizing tree trunks and causing “white rot” and “brown rot” processes. This shortens the lifespan of trees, reduces productivity in orchards, and disrupts the biological balance of ecosystems. During expeditions conducted between 2008 and 2025, macroscopic and microscopic analyses of samples collected from various botanical-geographical zones revealed species belonging to the genera *Phellinus*, *Polyporus*, *Ganoderma*, *Fomes*, and *Schizophyllum*. Observations indicate that *Ganoderma applanatum* and *Schizophyllum commune* possess a wide substrate spectrum and are more broadly distributed in ecosystems, whereas *Fomes fomentarius* predominantly occurs on willow and poplar. These differences play a crucial role in phytosanitary risk assessment. The phytopathological significance of macromycetes lies in their ability to weaken the mechanical strength of wood, reduce productivity, and cause premature drying of trees. Insufficient awareness of preventive measures exacerbates the problem. Therefore, regular monitoring, sanitary cuttings, preparation of risk maps, and application of molecular-genetic identification methods are essential. Thus, the conducted studies demonstrate that the investigation of wood-decaying macromycetes in the Nakhchivan Autonomous Republic is of great scientific and practical importance both for maintaining ecological stability and for increasing agricultural productivity.

*Аннотация.* Нахичеванская Автономная Республика отличается богатой флорой и разнообразными экологическими условиями. Древесноразрушающие макромицеты, распространённые в регионе, оказывают серьёзное влияние на стабильность лесных и парковых экосистем. Они преимущественно относятся к классу Basidiomycetes, паразитируют

на древесине и вызывают процессы «белой гнили» и «бурой гнили». Это сокращает продолжительность жизни деревьев, снижает урожайность садов и нарушает биологическое равновесие экосистем. В ходе экспедиций 2008–2025 гг. макроскопический и микроскопический анализ образцов, собранных из различных ботанико-географических зон, выявил виды, относящиеся к родам *Phellinus*, *Polyporus*, *Ganoderma*, *Fomes* и *Schizophyllum*. Наблюдения показывают, что *Ganoderma applanatum* и *Schizophyllum commune* обладают широким спектром субстратов и более широко распространены в экосистемах, тогда как *Fomes fomentarius* преимущественно встречается на иве и тополе. Эти различия играют важную роль в оценке фитосанитарных рисков. Фитопатологическое значение макромицетов связано с их способностью ослаблять механическую прочность древесины, снижать продуктивность и вызывать преждевременное усыхание деревьев. Недостаточная осведомлённость о профилактических мерах усугубляет проблему. Поэтому необходимы регулярный мониторинг, санитарные рубки, составление карт рисков и применение молекулярно-генетических методов идентификации. Таким образом, проведённые исследования показывают, что изучение древесноразрушающих макромицетов в Нахичеванской Автономной Республике имеет важное научное и практическое значение как для сохранения экологической стабильности, так и для повышения продуктивности сельского хозяйства.

**Keywords:** Nakhchivan Autonomous Republic, macromycetes, wood-decaying fungi, phytopathological significance, ecological monitoring

**Ключевые слова:** Нахичеванская Автономная Республика, макромицеты, древесноразрушающие грибы, фитопатологическое значение, экологический мониторинг

The Nakhchivan Autonomous Republic is distinguished by its rich flora and diverse ecological conditions. Wood-decaying macromycetes occurring in this region exert a significant impact on the stability of forest and park ecosystems. They are large fungi belonging to the class Basidiomycetes, parasitizing mainly on tree trunks and causing “white rot” and “brown rot” diseases. As a result of these processes, the lifespan of trees is shortened, orchard productivity decreases, and the biological balance of forest ecosystems is disrupted.

The phytopathological significance of wood-decaying fungi has long been the focus of scientific attention. They are active producers of enzymes that degrade cellulose, hemicellulose, and lignin [1, 2].

This property leads to rapid decomposition of wood, resulting in both economic and ecological losses in orchards and forest stands [3].

The climate of the Nakhchivan Autonomous Republic — characterized by continental features, hot and arid summers, and cold and humid winters — creates a favorable environment for the distribution of macromycetes. Tree species such as *Salix* sp., *Populus* sp., *Prunus* sp., *Quercus* sp., and *Juglans* sp. are widely spread in the region, and their wood serves as the main substrate for macromycetes [4, 5].

The lack of awareness among the population about these fungi and the absence of preventive measures further aggravate the problem. Previous studies have recorded several new macromycete species in the mycobiota of the Azerbaijan and Nakhchivan Autonomous Republic [6-11].

Nevertheless, certain gaps remain, and aspects such as species distribution frequency, substrate-specific differentiation, and phytopathological mechanisms of impact have not yet been fully investigated. Therefore, the systematic study of wood-decaying macromycetes in the Nakhchivan

Autonomous Republic holds significant scientific and practical importance both for regional biology and for agriculture.

Our objective is to identify wood-decaying macromycetes distributed across various areas of the Nakhchivan Autonomous Republic, to study their bioecological characteristics, and to evaluate their phytopathological significance.

As research material, samples were collected from forests, parks, and orchards located in different botanical-geographical zones of the Nakhchivan Autonomous Republic. The samples were gathered during regular expeditions between 2008 and 2025 across different seasons (spring, summer, autumn). During this period, macromycetes occurring on both living and dead tree trunks and stumps were recorded. Observations in winter were limited, while active sampling was mainly conducted in spring and autumn. During sample collection, their substrates (living and dead tree trunks, stumps, branches) and ecological conditions (forest, park, orchard, foothill zones) were documented, and the frequency of distribution was determined.

The collected samples were subsequently brought to the laboratory, where macroscopic and microscopic analyses were conducted. In macroscopic analysis, the shape, size, color, surface structure, and substrate association of the fruiting bodies of fungi were examined. Identification of the samples was carried out based on available literature data [12-16].

The nomenclature and taxonomic status were determined according to the databases Index Fungorum (<http://www.indexfungorum.org>) and MycoBank (<http://www.mycobank.org>).

Microscopic analyses focused on the shape, size, and color of spores, the structure of lamellae, and the morphological characteristics of hyphae, using a light microscope. Additionally, the ecological characteristics of the species (substrate preference, distribution frequency, vegetation period) were recorded, and their phytopathological mechanisms of impact (white rot, brown rot) were identified.

As a result of the investigations, it was established that wood-decaying macromycetes in the territory of the Nakhchivan Autonomous Republic mainly belong to the genera *Phellinus*, *Polyporus*, *Ganoderma*, *Fomes*, and *Schizophyllum*.

Genus: *Phellinus* Quélet.

*Phellinus pomaceus* (Pers.) Maire. Found on living trees. Exhibits a facultative biotrophic lifestyle and causes white rot. The species was collected on April 23, 1962 by Akhundov from Gənzə village in the Ordubad district, and on September 15, 1962 from oak stumps at the Bichenek pass in the Shahbuz district [6].

Genus: *Polyporus* Mich. Pers.

*Polyporus squamosus* Huds.: Fr. Found occasionally on both living and dead trees. It is a facultative saprotroph and causes white rot. During summer and autumn, it occurs in broad-leaved forests and parks, on trunks and stumps of living and decaying trees. The species was collected on September 25, 2008 from stumps in Sələsüz village, and on July 2, 2008 from a decayed walnut stump (1400–1600 m) in Badamlı village [7, 10].

It was also collected on April 23, 1962 by T.M. Akhundov from Ganja village in the Ordubad district [6].

Genus: *Ganoderma* Karst.

*Ganoderma applanatum* (Pers. ex Wallr.) – Flat polypore The fruiting bodies of this fungus are perennial, occurring singly on substrates, sessile, and their size varies greatly depending on the habitat: diameter 5–40 cm, sometimes up to 60 cm, thickness 1.5–12 cm. The cap surface is uneven, wavy, often with swellings, covered with a thin crust that hardens quickly; its color is initially whitish-gray, later darkening.

The margins are straight and thin. During the vegetation period, this species mainly colonizes living stumps and weakened individuals of broad-leaved plants (genera such as *Juglans* L., *Malus* Mill., *Populus* L., *Quercus* L., *Salix* L., etc.). It is considered cosmopolitan.

Under natural conditions, it causes white rot. The distribution of the flat polypore in Azerbaijan was first recorded in the Lankaran — Astara zone [17].

Observations in the studied areas show that the flat polypore demonstrates strong adaptive potential to environmental conditions, which likely explains its ability to colonize various substrates in forest ecosystems and cause white rot.

*Ganoderma applanatum* was collected from walnut stumps. The species was collected by Akhundov on October 1, 1963 from the Bichenek pass in the Shahbuz district [6].

According to literature, it may also occur on *Quercus* sp., *Populus* sp., and *Salix* sp. It is a white rot-causing species and a perennial fungus visible throughout the year.

*Ganoderma lucidum* — This fungus mainly colonizes dead plant substrates - stumps, branches, and dried trunks — and only rarely occurs on living trees. Such colonization is possible when forest trees are physiologically weak or aged. The fruiting body is annual, sessile, and long-lasting; depending on the substrate, it may also develop a stipe. Both stipe and cap are covered with a shiny, lacquered surface, with dark-brown irregular ridges. Its color varies from white to brown depending on habitat conditions. Observations indicate that the lacquered polypore induces a relatively inactive “white rot” process in plant substrates.

The species was collected on September 17, 2014 from the trunk of an oak tree in the Bichenek forest of the Shahbuz district [15].

Genus: *Fomes* Gill.

*Fomes fomentarius* (L. ex Fr.) Fr. — This species colonizes broad-leaved trees, forming perennial fruiting bodies that are gray in color and resemble a horse's hoof. The species was collected on July 15, 1962 from the Bichenek pass in the Shahbuz district [6]. It has been collected from *Salix* L. (willow) and *Populus* L. (poplar) trees. According to literature, it may also occur on *Quercus* sp., *Ulmus* sp., *Prunus* sp., and others. It is popularly known as the “polypore fungus.” As a parasite, it causes white rot in the trees it inhabits, eventually leading to their drying and death.

Genus: *Schizophyllum* Fr.

*Schizophyllum commune* Fr. The cap measures 1–4 cm, kidney-shaped, dry, grayish or whitish. The gills are fan-shaped, thin, dark gray, pinkish, or whitish. The flesh is brown, later becoming whitish. Spores are cylindrical, colorless, measuring 3–4×1–1.5 μm. It occurs throughout the vegetation period on dry and decayed coniferous and broad-leaved trees.

The species is widespread across the Transcaucasus. It causes white rot and, by decomposing lignin, may also produce brown-colored rot. The species was collected on October 13, 2010 from a fallen hawthorn branch in the Bichenek forests [7, 10].

It was also collected by T.M. Akhundov on September 5, 1963 from the Bichenek pass [6].

Comparison of the collected species with literature sources shows that the obtained results are consistent with studies conducted on the flora of Azerbaijan [17–19].

However, differences were observed in terms of distribution frequency and substrate preference in the Nakhchivan region. For example, in the works of A. S. Sadigov, *Ganoderma lucidum* was mainly recorded on oak, whereas in our observations it was found both on oak and on dead stumps. In T. M. Akhundov's studies, *Fomes fomentarius* was more frequently noted on poplar, while in Nakhchivan it predominates on willow. *Schizophyllum commune* has been described as a cosmopolitan species, and our investigations confirm this. To summarize the observations, the distribution zones, substrates, and types of rot of the species are presented in the following table.

Table

SUBSTRATES AND DISTRIBUTION ZONES OF WOOD-DECAYING MACROMYCETES IN THE  
NAKHCHIVAN AUTONOMOUS REPUBLIC

| Species                      | Substrate                                                                                                              | Distribution zone                        | Type of rot                    |
|------------------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------|
| <i>Phellinus pomaceus</i>    | Living trees (oak stumps, walnut)                                                                                      | Ordubad (Ganza), Shahbuz (Bichenek)      | White rot                      |
| <i>Polyporus squamosus</i>   | Living and dead trees (walnut, oak)                                                                                    | Salasuz, Badamli, Ordubad (Ganza)        | White rot                      |
| <i>Ganoderma applanatum</i>  | Living stumps, weakened individuals ( <i>Juglans</i> , <i>Malus</i> , <i>Populus</i> , <i>Quercus</i> , <i>Salix</i> ) | Shahbuz (Bichenek), Lankaran-Astara zone | White rot                      |
| <i>Ganoderma lucidum</i>     | Dead substrates (stumps, branches, trunks), rarely living trees (oak)                                                  | Shahbuz (Bichenek forest)                | White rot                      |
| <i>Fomes fomentarius</i>     | Willow ( <i>Salix</i> ), poplar ( <i>Populus</i> ), also oak, elm, plum                                                | Shahbuz (Bichenek)                       | White rot                      |
| <i>Schizophyllum commune</i> | Dry and decayed coniferous and broad-leaved trees (e.g., hawthorn branch)                                              | Shahbuz (Bichenek), entire Transcaucasus | White rot, sometimes brown rot |

The analysis of the observations and the data presented in the table reveals the following bioecological characteristics:

*Phellinus pomaceus*: Mainly found on oak and walnut trees. Widely distributed in the Ordubad and Shahbuz districts. This species causes white rot, weakening the mechanical strength of the wood.

*Polyporus squamosus*: Observed on walnut and oak trees. More frequently recorded in the areas of Selesuz and Badamli villages of the Shahbuz district. It causes white rot and leads to rapid decomposition of wood.

*Ganoderma applanatum*: Found on walnut, oak, and willow trees. Widely distributed in the Bichenek forest of the Shahbuz district. Known for its perennial fruiting bodies, it causes white rot and weakens the structure of wood.

*Ganoderma lucidum*: Observed on oak trees and dead stumps. Recorded in the Bichenek forest. It causes white rot and, besides being phytopathologically harmful, also possesses medicinal significance.

*Fomes fomentarius*: Found on willow and poplar trees. Recorded in the Shahbuz district. It causes gray rot, reducing the quality of wood.

*Schizophyllum commune*: Found on coniferous and broad-leaved trees. Widely distributed in Shahbuz and other districts. Recognized as a cosmopolitan species, it causes both white and brown rot.

Thus, it has become clear that in the area *Ganoderma applanatum* and *Schizophyllum commune* possess a wide substrate spectrum, which contributes to their broader distribution within ecosystems. *Fomes fomentarius*, however, shows a preference mainly for willow and poplar. These differences play an important role in the assessment of phytosanitary risks of the species.

The phytopathological significance of macromycetes lies in their ability to reduce productivity in orchards, cause premature drying of trees, disrupt the balance of forest ecosystems, and lower the quality of timber. Species that cause white rot (e.g., *Ganoderma applanatum*) degrade lignin, thereby reducing the mechanical strength of wood, while species that cause brown rot (e.g., *Fistulina hepatica*) decompose cellulose, leading to rapid disintegration of timber. As a result of these processes, the lifespan of trees is shortened, productivity decreases, and ecosystem balance is disturbed. Preventive measures, however, are not sufficiently known among the population and therefore are not

implemented, although a phytopathological approach could effectively prevent such losses. To reduce the phytosanitary risks caused by macromycetes, several measures are recommended. Regular monitoring should be carried out in orchards, infected trees should be cleaned in time, and sanitary cuttings should be implemented. Phytosanitary measures should be applied according to the type of rot, while ecological monitoring should be conducted in forest and park areas, and risk maps should be prepared. Future studies should employ molecular-genetic identification methods, and public awareness activities should be strengthened among the local population. Thus, it has been established that wood-decaying macromycetes represent an important group of fungi both ecologically and economically. Their study is essential for the protection of orchards and the maintenance of forest ecosystem health in the Nakhchivan Autonomous Republic.

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