



Medicinal Basidiomycetes of the Nuratau range (Uzbekistan): Ethnomedicinal uses and ethnomycological records

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Research

Abstract

Background: This article presents data on the taxonomic diversity, ecological distribution, bioactive potentials, and traditional folk remedies of valuable macrofungi in Central Asia. Despite the rich biodiversity and long history of traditional medicine in the region, scientific documentation of higher fungi remains extremely scarce compared to vascular plants. This study aims to fill this significant knowledge gap by systematically documenting the local traditional knowledge of the mountain communities, thereby preserving a rapidly eroding oral cultural heritage and providing a baseline for future bioprospecting.

Methods: Systematic field surveys were conducted across diverse mountain habitats between 2020 and 2026. Collected specimens were examined using standard macromorphological and micromorphological criteria, and representative voucher specimens were deposited in the Tashkent Mycological Herbarium (TASM). Socio-ecological data were collected between 2022 and 2023 through semi-structured questionnaire surveys and double-interviews with 60 local informants (aged 40 to 70 years) under informed consent and in accordance with international ethical guidelines.

Results: A total of 27 species belonging to 19 genera and 12 families were documented. At the family level, Polyporaceae (8 species) and Agaricaceae (6 species) exhibited the highest taxonomic diversity. Gasteroid puffball species - including *Bovista plumbea*, *Calvatia cyathiformis*, and *Calvatia gigantea* - are locally recognized under the vernacular names "Ilon telpak", "Eshakhina", or "Telpaki mor". Their mature dry spore powder is traditionally used as a topical hemostatic and antiseptic agent to treat cuts, burns, and purulent wounds. In the Forish district, a specialized animal care practice was recorded where

C. gigantea spore powder is mixed with petroleum jelly or industrial grease (Solidol) to treat severe, chronic wounds in working horses and donkeys. Furthermore, *Pleurotus eryngii* ("Chanbush"), *Pleurotus ostreatus*, *Agaricus bitorquis*, and *Agaricus campestris* ("Qo'zidumba") are highly prized as seasonal spring foods, with local communities attributing anti-diabetic properties to *P. eryngii*. Conversely, highly abundant wood-decaying species with proven global pharmacological value, such as *Phellinus igniarius* and *Trametes versicolor*, *Ganoderma resinaceum* show no record of traditional utilization due to a strict cultural filter.

Conclusions: The study successfully characterized the ecological and taxonomic diversity of 27 macrofungi and documented their active roles in local primary healthcare and veterinary practices. The traditional knowledge is highly localized and primarily preserved by older generations, highlighting an urgent need for conservation. Protecting these fragile mountain habitats within the strict nature reserve is essential to safeguard both the host tree species and the genetic resources of these valuable fungi.

Keywords: Gasteroid puffballs, *Pleurotus eryngii*, *Calvatia gigantea*, ethnoveterinary, white-rot decomposers, traditional knowledge erosion, Uzbekistan, Central Asia.

Background

Medicinal macrofungi are globally recognized as rich natural sources of diverse bioactive metabolites, including polysaccharides, triterpenoids, phenolics, and sterols, which exhibit potent immunomodulatory, antioxidant, antimicrobial, and anticancer properties. Traditional knowledge regarding their therapeutic applications constitutes a vital component of ethnomycology and serves as an essential primary healthcare and ethnoveterinary resource, particularly for remote rural and mountainous communities with constrained access to modern pharmaceuticals. Furthermore, this orally transmitted cultural heritage provides a foundational baseline for modern bioprospecting and natural drug discovery. However, rapid socio-economic transitions, urbanization, and land-use changes pose severe threats to the preservation of these traditional practices, underscoring an urgent imperative for systematic, analytical documentation. Despite the accelerating momentum of ethnobiological research globally, Central Asia remains heavily underrepresented in published ethnomycological literature. Although the region harbors diverse ecosystems and a deep-seated tradition of folk medicine, historical scientific documentation in Uzbekistan has focused almost exclusively on vascular flora, leaving macrofungal diversity, ecological drivers, and traditional uses fragmented or completely unrecorded. The Nurata Range in central Uzbekistan represents an ecologically and culturally unique mountainous landscape characterized by distinct altitudinal belts and high vascular plant diversity. Although recent studies have surveyed vascular plants and micromycetes in this territory, the ethnomycological knowledge of local mountain communities and the ecological factors governing fungal utilization remain poorly understood. To move beyond purely descriptive documentation and address broader socio-ecological dynamics in Central Asian mycology, this study comprehensively evaluates the medicinal basidiomycete diversity of the Nurata Range. Specifically, the investigation is structured around three main testable hypotheses derived from regional habitat structures and local ethnomedicinal practices:

H1 (Ecological and Elevation-Driven Distribution): The species richness, spatial distribution, and taxonomic diversity of medicinal macrofungi across the Nurata Range are primarily structured by elevation gradients, substrate availability, and host-plant specificity (e.g., wood-decaying polypores associated with broadleaf *Juglans*, *Populus*, and *Salix* stands versus gasteroid taxa inhabiting open subalpine pastures).

H2 (Cultural Selection Filter): Local ethnomycological practices do not passively mirror total ecological abundance; instead, they operate under a strict traditional "cultural filter." Consequently, abundant and globally recognized medicinal xylotrophic species (e.g., *Cerrena unicolor*, *Cerioporus squamosus*) remain completely unutilized, whereas traditional applications are narrowly concentrated on specific gasteroid puffballs (*Bovista plumbea*, *Calvatia gigantea*) and seasonal edible taxa (*Agaricus* spp., *Pleurotus* spp.).

H3 (Specialized Ethnoveterinary Knowledge and Demographic Erosion): Highly specialized ethnomycological applications – such as traditional ethnoveterinary wound treatments using puffball spore pastes—are non-randomly distributed, exhibiting localized preservation among older livestock herders in isolated districts (e.g., Forish district) alongside broader knowledge erosion across younger socio-demographic strata.

By testing these hypotheses through systematic field sampling, taxonomic verification, and semi-structured socio-ecological surveys, this study establishes a robust analytical baseline for the Nurata Range, contributing to the preservation of traditional biocultural heritage and providing empirical support for fungal resource conservation and bioprospecting in Central Asia.

Materials and Methods

Study Area

The study was conducted in the Nuratau Ridge, located within the Nuratau Mountains in central Uzbekistan (39°50′–40°50′ N, 65°00′–67°50′ E) (Fig. 1).

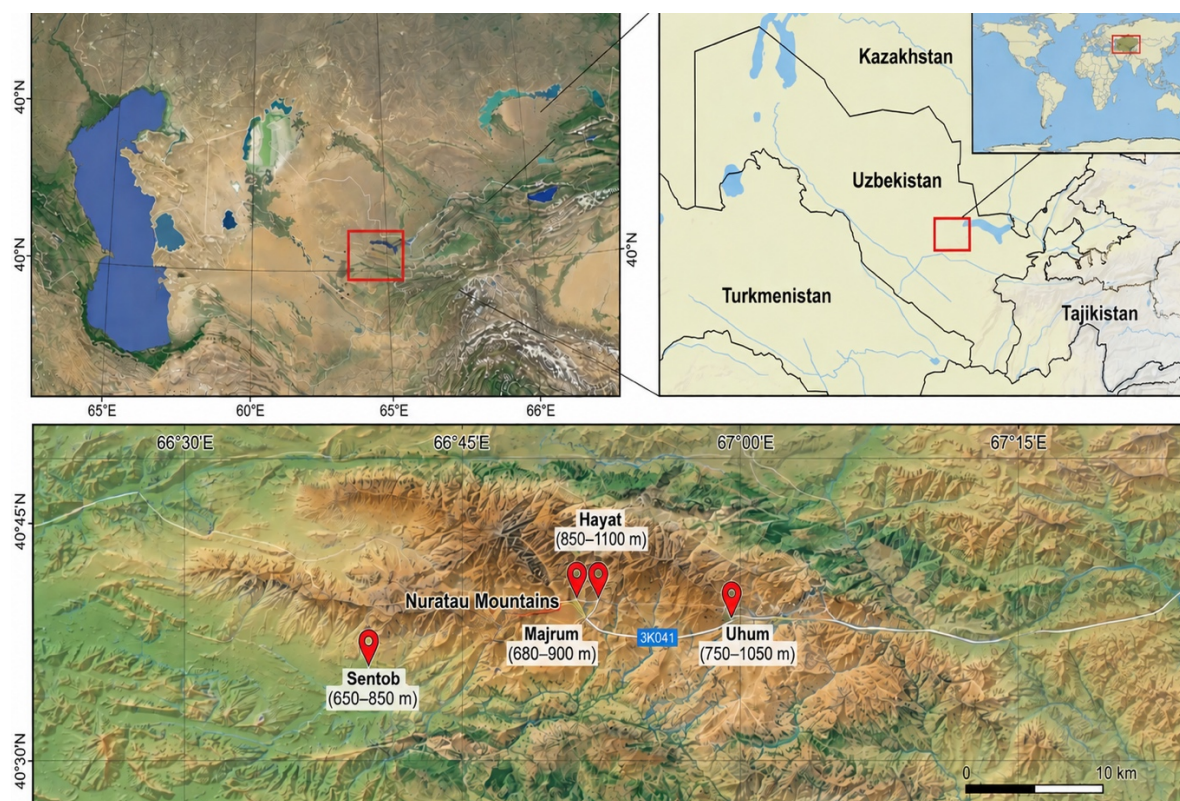


Figure 1. Geographic location and topographic map of the study area: (top-left) satellite view of Central Asia highlighting Uzbekistan and the study region; (top-right) regional administrative map of Uzbekistan with global position insert; (bottom) detailed topographic and elevation map of the Nuratau Mountains showing the sampling sites (Sentob, Majrum, Hayat, and Uhum with their respective altitudes).

The Nuratau Mountains consist of two parallel medium-altitude semi-arid mountain chains with several adjacent insular low ranges, covering an area of approximately 14,000 km² and extending about 250 km in a sub-latitudinal direction across the Jizzakh, Samarkand, Navoi, and Bukhara Regions. According to the modern phytogeographical classification of Central Asia, this territory belongs to the Nuratau phytogeographical district of the Mountain Central Asian Province. The climate of the Nurata Ridge is continental, dry, and relatively warm. Due to its moderate elevation and latitudinal orientation, the ridge does not form a strong barrier for humid western air masses that bring most of the precipitation to Central Asia. The proximity of the Kyzylkum Desert and the Golodnaya Steppe strongly influences the regional climate, reducing climatic differences between the northern and southern slopes. The average annual precipitation within the area is approximately 300–400 mm, with most precipitation occurring in winter and spring. Summers are long, hot, and dry, whereas winters are unstable with considerable temperature fluctuations. The frost-free period lasts approximately 315 days. An important, protected area within the region is the Nurata Nature Reserve, located in the central part of the Nuratau Ridge. The reserve covers 17,752 hectares and is surrounded by a buffer zone of 22,830 hectares. Established in 1975, the reserve is classified as a strict nature reserve (Category Ia) by the International Union for Conservation of Nature and was created to conserve the unique ecosystems, flora, and fauna of the Nuratau Mountains, including relict walnut-fruit forests and the globally threatened Severtzov's argali (Beshko *et al.* 2025).

The vegetation of the Nuratau Range is predominantly xerophytic and reflects the arid conditions of the region. The plant cover is highly heterogeneous due to the complex and strongly dissected relief, resulting in diverse microclimatic conditions. Herbaceous and semi-shrub vegetation types dominate across most of the area. Lower elevations (400-800 m) are characterized by ephemeral and wormwood-ephemeral communities dominated by species such as *Artemisia diffusa*, *Carex pachystylis*, and *Poa bulbosa*. At elevations of 800-1200 m, wormwood-ephemeral communities and large-herb associations dominated by *Cousinia korolkovii* and *Prangos pabularia* are common. At higher elevations (1000-1800 m), xerophytic shrublands occur on rocky and gravelly slopes, including species of *Atraphaxis*, *Cotoneaster*, and *Rosa*, as well as *Acer semenovii* and *Ephedra equisetina*. Above 1500 m, the vegetation is dominated by steppe communities composed mainly of perennial grasses such as *Festuca*, *Poa*, and *Elymus*. In some valleys and moist habitats, riparian vegetation occurs, including wild walnut-fruit groves and mesophytic species such as *Populus*, *Salix*, and *Mentha*. Overall, the vegetation of the Nuratau Range represents typical plant formations of arid middle-altitude mountain ecosystems of Central Asia (Beshko et. al., 2025).

Field surveys and ethnomycological investigations were systematically carried out across four key mountain settlements in the Nurata Range: Sentob, Majrum, Hayat, and Uhum. These study sites span a distinct altitudinal gradient from 650 to 1100 m a.s.l. and encompass diverse micro-habitats, ranging from deep riparian canyon forests to semi-arid scrublands and montane terrace gardens. The local vegetation is dominated by key fungal host trees and shrubs, including *Juglans regia*, *Populus* spp., *Salix* spp., *Crataegus* spp., and fruit tree orchards (*Malus* spp., *Prunus* spp., *Morus* spp.), which provide essential organic substrates for wood-decaying and mycorrhizal macrofungi. From a socio-cultural perspective, all study participants across the sampled villages self-identified as ethnically Tajik, natively speaking Tajiki (Glottolog code: taji1245) and adhering to Sunni Islam. Detailed spatial coordinates, altitude ranges, host-plant associations, and participant demographic profiles (n = 63) for each sampled location are comprehensively summarized in Table 1.

Table 1. Geographical, ecological, and socio-demographic profiles of the four study settlements in the Nurata Range, Central Uzbekistan.

Settlement	Geographic Coordinates & Elevation	Ecological Setting & Dominant Host Trees	Language & Religion	Total Population (2025)	Participants (n, Gender, Age, Profile)
Sentob	40°25' N, 66°36' E (650–850 m)	Deep mountain canyon & riparian forest (<i>Juglans regia</i> , <i>Populus</i> spp., <i>Salix</i> spp., <i>Morus</i> spp.)	Tajiki (taji1245) Islam (Sunni)	2304	n = 16 (11M / 5F, 42–75 yrs) - Pastoralists & farmers
Majrum	40°31' N, 66°42' E (680–900 m)	Semi-arid scrubland & ancient woodland (<i>Salix alba</i> , <i>Juglans regia</i> , <i>Crataegus</i> spp.)	Tajiki (taji1245) Islam (Sunni)	690	n = 18 (12M / 6F, 42–65 yrs) - Farmers & herbalists
Hayat	40°31' N, 66°45' E (850–1100 m)	Valley stream banks & fruit orchards (<i>Juglans regia</i> , <i>Populus</i> spp., <i>Crataegus</i> spp., <i>Acer</i> spp., <i>Malus</i> spp., <i>Prunus</i> spp.)	Tajiki (taji1245) Islam (Sunni)	890	n = 15 (10M / 5F, 40–70 yrs) - Herder-collectors
Uhum	40°30' N, 66°47' E (750–1050 m)	Montane terrace gardens & broadleaf forest (<i>Juglans regia</i> , <i>Populus alba</i> , <i>Salix</i> spp., <i>Malus</i> spp.)	Tajiki (taji1245) Islam (Sunni)	840	n = 14 (9M / 5F, 38–72 yrs) - Herders & knowledge holders

Collection and Preservation of Medicinal Macrofungi Samples

Freshly collected basidiomata and ascomata of medicinal macrofungi were collected during systematic field surveys conducted in the Nurata Ridge between 2020 and 2026. The specimens were air-dried and subsequently examined in the Mycology Laboratory at the Tashkent botanical garden for taxonomic identification. Species determination was based on standard morphological criteria, supported by relevant taxonomic literature, including authoritative monographs and identification manuals. After morphological analysis, voucher specimens were deposited in the Tashkent Mycological Herbarium (TASM) at the Institute of Botany, Academy of Sciences of Uzbekistan. Voucher codes presented in Table 1 (e.g., TASM-AB-012) correspond to specimens deposited in TASM. Fungarium acronyms used in this study follow the Index Herbariorum.

Ethnomycological data collection

The ethnomycological study was carried out between 2022 and 2023 years. Sixty-three informants, aged between 38 and 75 years, were interviewed to gather ethnomycological data on medicinal macrofungi. All informants were interviewed at least twice for the collection of information regarding historical background, edibility status, traditional usage, methods of preservation, commercial importance of fleshy fungi and possible reasons for lower diversity of medicinal macrofungi and some plants in the region. The verification of the macrofungal species was done in the months of the rainy season, and the informants were requested to escort us during the field visit to confirm the species and information thereof. The identification of specimens and photographs already in our possession was also utilized in the research. In addition, scientific names of wild edible and medicinal fungi were checked for potential synonyms using Index Fungorum (2026) and MycoBank (Robert *et. al.* 2013).

Results

Comprehensive field and laboratory investigations carried out in the Nurata range between 2020 and 2026 revealed a notable diversity of medicinal basidiomycete macrofungi. Specimens were collected from a variety of habitats, including foothill zones, rocky slopes, riparian areas, and natural and semi-natural deciduous and mixed forest stands across different altitudinal ranges of the ridge. Fresh basidiomata were documented in situ, photographed, and processed for detailed morphological analyses, with representative voucher specimens preserved in institutional collections. Species identification was conducted using macromorphological and micromorphological characteristics, in accordance with contemporary taxonomic literature.

A total of 27 species of basidiomycete macrofungi were identified in the study area, belonging to 21 genera and 11 families (Fig.1). The genus *Agaricus* (with 2 species), *Calvatia* (2 species), *Ganoderma* (2 species), *Lentinus* (2 species), *Pleurotus* (2 species), *Stropharia* (2 species), and *Volvariella* (2 species) were the most represented taxa in terms of species richness. At the family level, Polyporaceae and Agaricaceae exhibited the highest taxonomic diversity, comprising 8 and 6 species, respectively. These were followed by Hymenochaetaceae, Pleurotaceae, Pluteaceae, and Strophariaceae with 2 species each. The remaining families, including Laetiporaceae, Phallaceae, Physalacriaceae, Schizophyllaceae, Tricholomataceae, and Tremellaceae, were represented by a single species each. Among the recorded taxa, several ecologically and economically important species were documented, including widely collected edible mushrooms such as *Agaricus bitorquis*, *Collybia personata*, and *Pleurotus ostreatus*, alongside notable wood-decaying polypores like *Fomes fomentarius* and *Ganoderma resinaceum*.

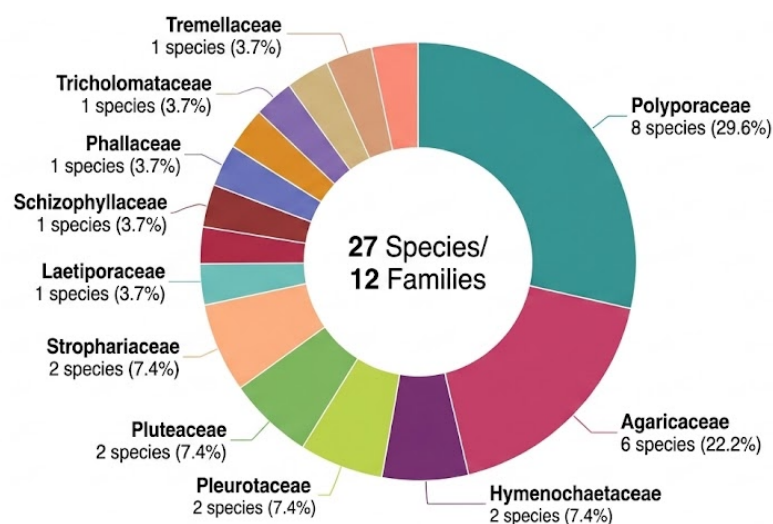


Figure 2. Family-level taxonomic diversity and species richness of basidiomycete medicinal macrofungi recorded in the Nuratau Range (N = 27 species belonging to 12 families).

Agaricus bitorquis (Qué.) Sacc., Syll. Fung. 5: 998 (1887) [MB#213898] (Table 2)

Morphological description. Basidiomata medium- to large-sized. Pileus 40-120 mm in diameter, initially hemispherical to convex, flattening to broadly convex or plane with a slightly depressed center at maturity; surface smooth, dry, white to creamy-white, sometimes becoming pale yellowish-ochraceous with age or when bruised, often carrying soil debris due to its subhypogeous development. Lamellae free, narrow, crowded, light pink when young, turning dark chocolate-brown to blackish at maturity. Stipe 30-70 × 15-35 mm, central, cylindrical, robust, solid, white, featuring a prominent, thick, double-

banded sheathing annulus (sheath-like ring). Context firm, white, unchanging or slowly turning faint pinkish-red when cut; odour and taste pleasantly fungoid. Basidiospores dark brown in spore print. The morphological characteristics observed in the present study correspond well with previous taxonomic descriptions of the species (Bas, 1991).

Distribution and habitat in the Nurata Range. *Agaricus bitorquis* is commonly found in open grasslands, meadows, and other habitats with humus-rich soils in the Nurata Range. Fruiting bodies are typically observed during the spring (March-May), following seasonal precipitation. Although the species is primarily associated with natural ecosystems, it has also been recorded in disturbed habitats, along hard-packed roadsides, and near human settlements, indicating a broad ecological tolerance and high resistance to soil compaction. Owing to its pleasant taste and firm texture, *A. bitorquis* is regarded as an edible mushroom of high culinary value (Kerrigan, 2016).

Bioactive compounds and medicinal potential. *A. bitorquis* contains a variety of biologically active compounds, including intracellular polysaccharides and lectins, which contribute to its pharmacological potential. Polysaccharides isolated from the fruiting bodies have demonstrated anti-hypoxic activity in cellular models by modulating cellular metabolism under low-oxygen conditions; these macromolecules are composed mainly of glucose and galactose and also exhibit robust antioxidant properties (Zhang *et al.* 2019). In addition, ethyl acetate extracts of *A. bitorquis* have shown significant antioxidant, antimicrobial, and anticholinesterase activities *in vitro*, supporting their potential application in the development of functional foods and nutraceutical products (Kuang *et al.* 2020). Purified lectins from the basidiomata have exhibited inhibitory activity against HIV-1 reverse transcriptase, selective cytotoxicity toward leukemia cell lines, and mitogenic activity, highlighting promising pharmaceutical avenues (Jiao *et al.* 2019). Collectively, these findings underscore the medicinal potential of *A. bitorquis* and warrant further investigations into its pharmacologically active constituents (Yildiz *et al.* 2011).

Ethnomycological records in the Nurata Range. According to interviews conducted with local residents during the present study, *A. bitorquis* is traditionally collected as a highly valued edible mushroom during the spring fruiting season. The species is locally recognized as an important wild food resource, and the collected fruiting bodies are usually cooked before consumption, being commonly added to soups, stews, or mixed with traditional cereal-based dishes. Local communities highly appreciate the species because of its nutritional value and pleasant taste. In addition to domestic consumption, some local collectors also sell freshly harvested fruiting bodies along roadsides and in local markets, providing a vital seasonal source of supplementary household income (Fig. 1). In traditional knowledge, regular consumption of this mushroom is believed to promote general health and physical well-being. These observations demonstrate that *A. bitorquis* serves not only as an important seasonal food resource and an economic asset, but also as a culturally significant component of the traditional diet in the Nurata Range.



Figure 3. Roadside sale of wild *Agaricus bitorquis* in the Nuratau range (left), and close-up of harvested specimens in a basin showing pileus details (right).

***Agaricus campestris* L., Sp. Pl. 2: 1173 (1753) [MB#356498] (Table 2, Fig. 4C)**

Morphological description. Basidiomata medium-sized. Pileus 30-70 mm in diameter, initially convex, becoming broadly convex to plane at maturity; surface silky to finely fibrillose, white when young, gradually bruising ochraceous-brown, often with adhering soil particles. Lamellae free, crowded, pink in young basidiomata, becoming dark brown at maturity. Stipe 25-45 × 10-30 mm, central, cylindrical, solid, white, with a well-developed double annulus. Context white, slowly turning reddish-brown when bruised or cut; odour and taste pleasant. Basidiospores dark brown in spore print. The morphological characteristics observed in the present study correspond well with previous descriptions of the species (McKenzie *et. al.* 1999).

Distribution and habitat in the Nurata Range. *Agaricus campestris* is a saprotrophic macrofungus commonly occurring in grasslands, meadows, and open pastures of the Nurata Ridge, where it grows on humus-rich soils. Fruiting bodies are mainly produced during the spring (April-May) following seasonal rainfall. Although predominantly associated with natural grassland ecosystems, the species has also been recorded in disturbed grasslands and near rural settlements, indicating considerable ecological plasticity. Owing to its excellent edible qualities, *A. campestris* is among the most frequently collected wild mushrooms in the study area (Dahlberg, 2019).

Bioactive compounds and medicinal potential. *Agaricus campestris* contains numerous biologically active compounds that contribute to its medicinal potential. Extracts of the fruiting bodies have demonstrated pronounced antioxidant activity owing to their high phenolic content, together with antimicrobial effects against several pathogenic microorganisms. Recent studies have also reported antiproliferative activity against selected cancer cell lines, suggesting the presence of bioactive metabolites with potential pharmaceutical applications. These findings indicate that *A. campestris* represents a promising source of natural compounds for the development of functional foods and nutraceutical products (Gürgen, Sevindik, 2025).

Ethnomycological records in the Nurata Range. According to interviews conducted with local residents during the present study, *A. campestris* is one of the most highly appreciated wild edible mushrooms in the Nurata Range. The species is locally known as “Oq zamburug” and “Qo’zidumba” and is commonly collected during its spring fruiting season (April-May). Fruiting bodies are usually fried or added to traditional dishes and are valued for their pleasant taste and nutritional value (Mustafayev *et. al.* 2025). Similar ethnomycological surveys conducted in other regions have likewise identified *A. campestris* as an important traditional food resource, highlighting its nutritional significance and long-standing role in local culinary traditions (Shafiq & Sahib, 2025).

***Bovista plumbea* Pers., Observationes mycologicae 1: 5 (1796) [MB#209632] (Table 2, Fig.4D)**

Morphological description. Basidiomata subglobose to depressed-globose, 2-5 cm in diameter, occurring singly or in small groups. Exoperidium initially smooth and pale grey to greyish-brown, becoming thin and flaking away at maturity to expose a smooth, smoke-grey endoperidium. Gleba white in immature basidiomata, gradually changing to brown and finally dark sepia at maturity. Capillitium of the *Bovista* type, thick-walled, branched, and non-septate. Basidiospores subglobose to broadly ellipsoid, 4.5-6.0 × 4.0-5.5 µm, pale yellowish-brown and finely asperulate. The specimens collected from the Nurata Ridge correspond well with published descriptions of the species (Krakhmalnyi *et. al.* 2023).

Distribution and habitat in the Nurata Range. *B. plumbea* is a saprotrophic gasteroid fungus commonly found in open grasslands, meadows, pastures, and roadside habitats of the Nurata Ridge. It grows on well-drained soils, either singly or in small groups, and fruits mainly during spring and early summer following rainfall. The species exhibits considerable ecological plasticity and has also been reported from sandy grasslands, coastal dunes, and occasionally open woodland habitats in other parts of its distribution range (Kreisel, 2001; Bates *et. al.* 2009).

Bioactive compounds and medicinal potential. Species of the genus *Bovista* have long been recognized as sources of biologically active compounds. The mature gleba, particularly the spore powder, has traditionally been associated with hemostatic, antimicrobial, and wound-healing properties. Experimental studies on puffball fungi have demonstrated antimicrobial and anti-inflammatory activities, supporting their potential medicinal applications. Although pharmacological investigations specifically focusing on *B. plumbea* remain limited, available evidence suggests that this species may possess similar therapeutic potential and merits further phytochemical and pharmacological investigation (Wasser, 2010; Alves *et. al.* 2012).

Ethnomycological records in the Nurata Range. Interviews conducted during the present study revealed that *B. plumbea* is traditionally used as a medicinal mushroom by local communities in the Nurata Range. The species is locally known as

“Eshakhina.” Mature fruiting bodies are collected, dried, and stored. When required, the mature spore mass is released from the dried basidiomata and applied directly to burns, cuts, and purulent wounds. According to local informants, the powder is believed to promote wound healing, reduce inflammation, and help stop minor bleeding. A particularly noteworthy ethnoveterinary practice was documented during the interviews. Local mountain residents reported using the mature spore powder to treat severe wounds in working horses and donkeys. For deep or chronic wounds, the spore powder is traditionally mixed with a small amount of petroleum jelly or a commercial healing ointment (e.g., Solidol-type grease or petroleum jelly) to form a paste, which is then applied directly to the affected area. In contrast, for purulent or exudative wounds, the dry spore powder is applied directly in a thick layer without mixing, as it is believed to absorb wound exudates and promote healing. Similar ethnomycological practices have previously been documented in the neighboring Kattakurgan District of the Samarkand Region, suggesting that this traditional knowledge has been preserved across culturally and geographically connected communities of central Uzbekistan. These observations are consistent with ethnomycological reports describing puffball fungi as topical medicinal agents in various parts of the world (Wasser, 2010).

***Calvatia cyathiformis* (Bosc) Morgan, J. Cincinnati Soc. Nat. Hist. 12: 168 (1890) [MB#356862] (Table 2).**

Morphological description. *C. cyathiformis* is a gasteroid basidiomycete producing globose to subglobose basidiomata, typically 5-15 cm in diameter. The exoperidium is smooth to slightly cracked, whitish to pale brown, becoming darker with age. The gleba is initially white and firm, gradually changing to a characteristic purplish to violet-brown color at maturity, which is an important diagnostic feature of the species. After spore dispersal, a persistent sterile basal cup remains. Basidiospores are globose, ornamented, measuring 3.5-7.5 μm in diameter, and the capillitium consists of thick-walled, branched hyphae (Davis *et. al.* 2012).

Distribution and habitat in the Nurata Range. *C. cyathiformis* is a saprotrophic macrofungus widely distributed throughout temperate regions of Europe, Asia, and North America. It commonly occurs in grasslands, meadows, and pastures, growing on soils rich in organic matter, either singly or in small groups following seasonal rainfall. In the Nurata range, the species has been recorded in riparian habitats and open grassy areas with exposed soils, where adequate moisture and organic substrates support its seasonal development.

Bioactive compounds and medicinal potential. Species of the genus *Calvatia* are known to contain a variety of biologically active compounds, including phenolic compounds, polysaccharides, and fatty acids with antioxidant properties. Previous studies on *Calvatia* species have demonstrated strong free radical scavenging activity, considerable nutritional value, and promising pharmacological potential, suggesting that *C. cyathiformis* may represent a valuable source of bioactive compounds. Members of the genus have also attracted attention as potential sources of functional foods and nutraceutical products owing to their biochemical composition (Kivrak *et. al.* 2016; FAO/AGRIS, 2009).

Ethnomycological records in the Nurata Range. According to interviews conducted during the present study, local communities generally do not distinguish *C. cyathiformis* from *Bovista plumbea*, considering both species to possess similar medicinal properties. Mature fruiting bodies are collected, dried, and stored for future use. When needed, the mature spore mass is applied directly to burns, cuts, and purulent wounds, where it is traditionally believed to promote wound healing, reduce inflammation, and help stop minor bleeding. Local informants reported that *C. cyathiformis* is used in the same manner as *B. plumbea*, reflecting a shared body of traditional ethnomycological knowledge. These observations are consistent with ethnomycological reports describing puffball fungi as traditional topical medicinal agents in various regions of the world (Hedavoo, 2019).

***Calvatia gigantea* (Batsch) Lloyd, Mycol. Writ. 1 (16): 166 (1904) [MB#265958] (Table 2, Fig. 4B)**

Morphological description. *C. gigantea*, commonly known as the giant puffball, is one of the largest gasteroid basidiomycetes, producing globose basidiomata that may exceed 50 cm in diameter. The peridium is thin, smooth, and white in young specimens, becoming yellowish-brown and fragile with age. Unlike most members of the Lycoperdaceae, the peridium consists of a single layer and lacks a pseudoparenchymatous endostratum, making the fruiting body remarkably light. The gleba is initially white and compact, gradually becoming olive-brown and powdery at maturity as spores develop (Li, 2011).

Distribution and habitat in the Nurata Range. *C. gigantea* is a widely distributed saprotrophic macrofungus occurring throughout temperate regions of Europe, Asia, and North America. In the Nurata Ridge, it is found mainly in meadows, pastures, gardens, and other nutrient-rich open habitats, as well as at the edges of deciduous woodlands. Fruiting bodies

usually appear after seasonal rainfall on humus-rich soils, reflecting the saprotrophic ecology of the species (Krakhmalnyi *et al.* 2023).

Bioactive compounds and medicinal potential. *C. gigantea* has attracted considerable scientific interest because of its diverse bioactive compounds, including polysaccharides, phenolic compounds, proteins, and other secondary metabolites. Extracts of the fruiting bodies exhibit pronounced antioxidant activity through free radical scavenging and reducing capacities (Bhunia *et al.* 2017; Zhang *et al.* 2018). In addition, antimicrobial activity has been demonstrated against several pathogenic microorganisms, including *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans* (Owaid *et al.* 2019). Polysaccharide fractions have also shown antiproliferative and immunomodulatory activities in vitro, suggesting potential applications in functional foods, nutraceuticals, and complementary medicine (Zhang *et al.* 2018; Wasser, 2010). Collectively, these studies indicate that *C. gigantea* is a promising source of biologically active compounds with antioxidant, antimicrobial, and immunomodulatory properties.

Ethnomycological records in the Nurata Range. Interviews conducted during the present study revealed that *C. gigantea* is traditionally used as a medicinal mushroom by local communities of the Nurata Range, particularly in the Forish District. The species is locally known as “Ilon telpak” (Uzbek) and “Telpaki mor” (Tajik). Mature fruiting bodies are collected, dried, and stored for future use. When needed, the mature spore mass is removed and mixed with petroleum jelly (Vaseline) to prepare a topical paste that is applied to external wounds in horses and donkeys. According to local informants, this traditional remedy is believed to reduce infection, accelerate wound healing, and promote tissue recovery. Similar wound-healing applications of puffball fungi (*Calvatia* and *Lycoperdon* spp.) have been reported from Europe, North America, and East Asia, where mature spores have traditionally been used as topical hemostatic and antiseptic agents (Hobbs, 2002; Wasser, 2010; Zhang *et al.* 2018). These cross-cultural similarities suggest that the ethnomycological knowledge preserved in the Nurata Range forms part of a broader traditional practice associated with medicinal puffball fungi.

***Cerioporus squamosus* (Fr.) Quél., Enchiridion Fungorum in Europa media et praesertim in Gallia Vigentium: 167 (1886) [MB#163056] (Table 2, Fig. 4F)**

Morphological description. *C. squamosus* is an annual wood-decaying basidiomycete producing large, sessile, fan-shaped to semicircular basidiomata, often occurring singly or in overlapping clusters. The pileus is broad (10–50 cm), cream to yellowish-brown, and covered with characteristic dark brown concentric scales. The hymenophore is poroid, with angular pores that are white to cream when young and become yellowish with age. The context is thick, white, and fibrous. Basidiospores are cylindrical to ellipsoid, smooth, and hyaline, while the hyphal system is dimitic with generative and skeletal hyphae (Bernicchia & Gorjón, 2020; Ryvarden & Melo, 2014).

Distribution and habitat in the Nurata Range. *C. squamosus* is a widely distributed saprotrophic and weakly parasitic polypore occurring in temperate regions of Europe, Asia, and North America. It mainly colonizes weakened, damaged, or dead broadleaf trees, including *Juglans*, *Populus*, *Salix*, *Acer*, and *Fagus*, where it causes white rot and contributes to lignocellulose decomposition and nutrient cycling in forest ecosystems (Ryvarden & Melo, 2014; Bernicchia & Gorjón, 2020). In the Nurata Ridge, *C. squamosus* is frequently recorded on walnut (*Juglans regia*), poplar (*Populus* spp.), and willow (*Salix* spp.) trees. Fruiting bodies commonly develop on tree stumps, fallen logs, and weakened living trees, especially in orchards, riparian habitats, and areas surrounding rural settlements. Its frequent occurrence demonstrates its ecological adaptability to semi-arid mountain environments and anthropogenically influenced habitats.

Bioactive compounds and medicinal potential. *C. squamosus* contains various biologically active compounds, including polysaccharides, phenolic compounds, and other secondary metabolites. Extracts of this species have demonstrated antioxidant and antimicrobial activities, indicating potential value for functional food and natural product research (Wasser, 2014). However, compared with extensively studied medicinal polypores such as *Ganoderma* spp. and *Trametes versicolor*, the pharmacological potential of *C. squamosus* remains relatively poorly investigated and requires further biochemical and biological evaluation.

Ethnomycological records in the Nurata Range. *C. squamosus* is traditionally recognized as an edible wild mushroom in several European and Asian regions, where young fruiting bodies are collected and consumed after cooking. Due to the development of a tough and fibrous texture during maturation, only young specimens are generally considered suitable for culinary use (Boa, 2004; Christensen & Heilmann, 2008).

According to field observations and interviews conducted in the Nurata Range, although *C. squamosus* is frequently encountered on walnut, poplar, and willow trees, local communities do not traditionally collect or consume this species. This limited utilization may be related to insufficient ethnomycological awareness rather than the absence of edible potential. The documentation of such neglected edible fungi contributes to the understanding of local fungal diversity and provides a basis for future studies on sustainable utilization of wild mushroom resources in the region.

***Cerrena unicolor* (Bull.) Murrill, J. Mycol. 9 (2): 91 (1903) [MB#356790] (Table 2)**

Morphological description. *C. unicolor*, commonly known as the mossy maze polypore, is an annual wood-decaying polypore producing thin, overlapping (imbricate) basidiomata that are often laterally fused and occasionally resupinate. Fruiting bodies reach up to 10 cm in width and approximately 5 mm in thickness. The upper surface is concentrically zoned, varying from hairy to almost smooth, with grayish to brown colors that are frequently covered by green algal growth. The margin is thin, undulating, and lighter in color. The hymenophore is cream to ivory when young, gradually becoming grayish and finally brown with age. Pores are irregular, daedaleoid to labyrinthine, with 2-4 pores per mm and thick tomentose dissepiments. The context is distinctly layered, consisting of a lower pale corky layer and an upper darker, soft spongy layer separated by a thin dark line. The tube layer is similar in color to the lower context and may reach 1 cm in thickness. Cystidia are absent, although long clavate hyphal ends with thickened walls occur along dissepiment edges and older hymenia. Fusoid cystidioles are present in the hymenium. The hyphal system is trimitic, composed of thin-walled clamped generative hyphae, thick-walled non-septate skeletal hyphae, and branched binding hyphae. Basidia are clavate with four sterigmata, while basidiospores are cylindric to ellipsoid, smooth, hyaline, measuring $5-7 \times 2.5-4 \mu\text{m}$ (Bernicchia & Gorjón, 2020; Demir & Yamac, 2008).

Distribution and habitat in the Nurata Range. *Cerrena unicolor* is a widespread saprotrophic fungus distributed throughout temperate regions of Asia, Europe, and North America. In the Nurata Ridge, it occurs on dead or weakened hardwood trees, including *Celtis*, *Crataegus*, *Juglans*, *Populus*, and *Quercus*, where it causes white rot by degrading lignin and cellulose. The species is commonly encountered in deciduous forests and woodland habitats, where it plays an important ecological role in wood decomposition, nutrient recycling, and forest ecosystem functioning (Bernicchia & Gorjón, 2020).

Bioactive compounds and medicinal potential. *Cerrena unicolor* has attracted considerable scientific attention because of its production of biologically active exopolysaccharides, polysaccharides, and other secondary metabolites with diverse pharmacological properties.

Experimental studies have demonstrated significant antioxidant activity associated with its secretome and polysaccharide fractions, suggesting potential applications in nutraceuticals and functional foods (Jaszek *et al.* 2013).

The species also exhibits antimicrobial and hepatoprotective activities (Demir & Yamac, 2008; Uyanoglu *et al.* 2011), while extracts have shown antidiabetic effects in experimental models (Yamac *et al.* 2009). Furthermore, several studies have reported antiproliferative, proapoptotic, and migration-inhibiting effects against human colon cancer (HT-29) cell lines, highlighting its potential as a source of novel anticancer compounds (Matuszewska *et al.* 2018, 2019; Stefaniuk *et al.* 2021). Collectively, these findings indicate that *C. unicolor* represents a promising medicinal fungus with antioxidant, antimicrobial, antidiabetic, hepatoprotective, and anticancer potential.

Ethnomycological records in the Nurata Range. During the present study, no traditional medicinal or nutritional use of *Cerrena unicolor* was documented among local communities of the Nurata Ridge. Nevertheless, the species has a long history of ethnomedicinal use in East Asia, particularly in traditional Chinese medicine, where fruiting bodies and extracts have been used as antiseptic preparations and for the treatment of diabetes, infections, and liver disorders (Liu, 1984; Bernicchia & Gorjón, 2020). These traditional applications are consistent with modern pharmacological studies demonstrating antimicrobial, hepatoprotective, antioxidant, and immunomodulatory activities (Demir & Yamac, 2008; Uyanoglu *et al.* 2011), illustrating the continuity between traditional ethnomycological knowledge and contemporary biomedical research.



Figure 4. A - *Collybia personata*, B - *Calvatia gigantea*, C - *Agaricus campestris*, D - *Bovista plumbea*, E - *Fomes fomentarius*, F - *Cerioporus squamosus*. Photo credit by Ilyor Mustafaev.

***Collybia personata* (Fr.) Z.M. He & Zhu L. Yang, Fungal Diversity 123: 35 (2023) [MB#847253] (Table 2, Fig. 4A)**

Morphological description. *C. personata* (= *Lepista personata* (Fr.) Cooke) is a saprotrophic agaricoid basidiomycete producing large, fleshy basidiomata with a central stipe. The pileus is 5-15 cm in diameter, initially convex and becoming flattened with age, with a smooth white to yellowish surface often showing pinkish tones. Lamellae are crowded, adnate to slightly decurrent, cream to pinkish, and produce a pink spore print. The stipe is cylindrical, fibrous, and swollen at the base, lacking an annulus or volva, with a characteristic lilac-purple coloration. The flesh is whitish with a distinct farinaceous odor (Kalač (2013)).

Distribution and habitat in the Nurata Range. *C. personata* is widely distributed in temperate regions, occurring in deciduous forests, forest margins, meadows, and pastures. It grows as a saprotroph on organic-rich soils, contributing to decomposition processes and nutrient cycling. In the Nurata Range, the species was recorded mainly in riparian grasslands, streamside

habitats, and moist pastures, where fertile soils and accumulated organic matter provide suitable conditions for fruiting (Chang & Miles, 2004; Wasser, 2014).

Bioactive compounds and medicinal potential. *C. personata* contains several biologically active compounds, including polysaccharides, phenolic compounds, and flavonoids associated with antioxidant, antimicrobial, and immunomodulatory activities. Extracts from related *Lepista* species have demonstrated free-radical scavenging capacity, immune-stimulating effects, and potential protective activity against oxidative stress. Although pharmacological studies on *C. personata* remain limited compared with other medicinal mushrooms, available evidence suggests possible applications in functional foods and nutraceutical development (Wasser, 2014; Kalač, 2013).

Ethnomycological records in the Nurata Range. Interviews conducted during the present study revealed that *C. personata* is locally recognized as an edible wild mushroom. Local inhabitants collect young fruiting bodies during the favorable season and prepare them after cooking, commonly by frying with oil and onion. Some local collectors also sell freshly harvested fruiting bodies in local markets, providing a seasonal source of supplementary household income (Fig. 3). Similar culinary use of *Lepista* species has been documented in Europe and Central Asia, where they are valued as seasonal edible mushrooms. The continued collection and local trade of this species in the Nurata Range reflect the importance of wild edible fungi in local food traditions and contribute to the documentation of regional ethnomycological knowledge.



Figure 5. Roadside sale of wild *Collybia personata* in the Nurata Range (left), and close-up of specimens showing characteristic lilac-tinted stipes (right).

***Coprinus comatus* (O.F. Müll.) Pers., Tentamen dispositionis methodicae Fungorum: 62 (1797) [MB#148667] (Table 2)**

Morphological description. *C. comatus*, commonly known as the shaggy mane, is a saprotrophic agaricoid basidiomycete producing annual, solitary or gregarious basidiomata. The pileus is initially cylindrical to ovoid, gradually expanding to campanulate with age, reaching up to 15 cm in height and 6 cm in diameter. The pileus surface is white and densely covered with conspicuous shaggy scales that become smoother and grayish during maturation. Lamellae are free, crowded, and initially white, turning pink and subsequently black as the basidiospores mature. Mature fruiting bodies undergo rapid autodigestion (deliquescence), in which the lamellae and cap tissues dissolve into a characteristic black, spore-rich liquid. The stipe is cylindrical, hollow, white, and fibrous, slightly tapering toward the base, and bears a fragile, movable annulus derived from the partial veil. The hyphal system is monomitic, consisting of thin-walled, clamped generative hyphae. Basidia are clavate, bearing four sterigmata, while basidiospores are smooth, ellipsoid to ovoid, dark brown in mass, measuring $11\text{--}14 \times 5\text{--}6 \mu\text{m}$ (Watling, 2001; Arora, 1986).

Distribution and habitat in the Nurata Range. *C. comatus* is a cosmopolitan saprotrophic species widely distributed throughout temperate regions of Europe, Asia, and North America. It typically inhabits nutrient-rich soils in grasslands,

meadows, pastures, gardens, roadsides, and other disturbed habitats, where it develops singly or in dense clusters following seasonal rainfall. In the Nurata Ridge, the species was recorded on lawns, open grasslands, field margins, and areas rich in decomposing organic matter. By decomposing plant residues and other organic substrates, *C. comatus* contributes to nutrient recycling and soil fertility in both natural and anthropogenically influenced ecosystems (Watling, 2001).

Bioactive compounds and medicinal potential. *C. comatus* contains a wide range of biologically active constituents, including polysaccharides, lectins, phenolic compounds, ergothioneine, and other low-molecular-weight secondary metabolites. Numerous studies have demonstrated that extracts and purified polysaccharide fractions possess strong antioxidant activity through efficient free-radical scavenging and enhancement of endogenous antioxidant defense systems (Wang *et al.* 2015). Experimental investigations have also revealed hypoglycemic activity, indicating potential value in the dietary management of diabetes mellitus through improved glucose metabolism and insulin sensitivity. In addition, hepatoprotective, immunomodulatory, antimicrobial, and antiproliferative activities have been reported, supporting the potential application of *C. comatus* in functional foods, nutraceuticals, and complementary medicine (Wasser, 2014; Zhang *et al.* 2019). Collectively, current evidence identifies *C. comatus* as a promising medicinal mushroom with antioxidant, antidiabetic, hepatoprotective, antimicrobial, and immunomodulatory properties.

Ethnomycological records in the Nurata Range. Interviews conducted during the present study did not reveal any traditional medicinal use of *C. comatus* among local communities of the Nurata Range. Nevertheless, the species is widely recognized as an edible mushroom in many parts of Europe and Asia, where young fruiting bodies are collected before deliquescence and consumed as a seasonal food. In traditional medicine, it has also been used to alleviate digestive disorders and to support metabolic health, particularly in relation to blood glucose regulation (Wasser, 2014; Wang *et al.* 2015). These traditional applications are broadly supported by contemporary pharmacological studies demonstrating antioxidant, hypoglycemic, and immunomodulatory activities, illustrating the convergence of ethnomycological knowledge and modern biomedical research.

***Flammulina velutipes* (Curtis) Singer, Lilloa 22: 307 (1951) [MB#330940] (Table 2)**

Morphological description. *F. velutipes* is a saprotrophic agaricoid basidiomycete producing clustered basidiomata on decaying hardwood. The pileus is 30–80 mm in diameter, convex to plano-convex, smooth, viscid when moist, and yellowish-orange to reddish-brown with a darker center. Lamellae are adnate to slightly decurrent, white to cream, becoming pale yellow with age. The stipe is cylindrical, tough, and characteristically velvety, pale above and dark brown to black toward the base, lacking an annulus. The flesh is thin, whitish to pale yellow, with a mild odor and pleasant taste. Basidiospores are smooth and hyaline, and the hyphal system is monomitic with clamped generative hyphae (Bas *et al.* 1995).

Distribution and habitat in the Nurata Range. *F. velutipes* is a widely distributed saprotrophic species occurring throughout temperate regions of Asia, Europe, and North America. It colonizes dead trunks, fallen logs, branches, and stumps of deciduous trees, where it causes white rot and contributes to lignocellulosic decomposition. Unlike many temperate macrofungi, *F. velutipes* fruits during late autumn, winter, and early spring, exhibiting remarkable tolerance to low temperatures and light frost. In the Nurata Ridge, the species was recorded on decaying hardwood logs and tree stumps in forested and shrub-dominated habitats. Field observations indicate that *F. velutipes* is relatively uncommon in the study area, occurring sporadically in moist microhabitats associated with woody substrates (Dahlberg, 2019).

Bioactive compounds and medicinal potential. *F. velutipes* is recognized as one of the most extensively studied medicinal mushrooms because of its diverse array of bioactive constituents, including polysaccharides, phenolic compounds, proteins, sterols, and fungal immunomodulatory proteins. Polysaccharide fractions exhibit pronounced antioxidant activity by scavenging reactive oxygen species and enhancing endogenous antioxidant defense mechanisms. The species also produces the protein flammulin and other bioactive molecules with demonstrated antiproliferative activity against several human cancer cell lines. In addition, extracts have shown immunomodulatory, antimicrobial, anti-inflammatory, and antitumor activities, supporting their potential application in functional foods, nutraceuticals, and complementary medicine (Wasser, 2014; Zhang *et al.* 2022). Collectively, available evidence indicates that *F. velutipes* is a valuable source of biologically active compounds with antioxidant, antimicrobial, immunomodulatory, and anticancer properties.

Ethnomycological records in the Nurata Range. Interviews conducted during the present study did not document any traditional medicinal or culinary use of *F. velutipes* among local communities of the Nurata Ridge. Nevertheless, the species is among the most economically important edible mushrooms worldwide and has been cultivated for centuries in East Asia, where it is widely known as “enoki.” Young fruiting bodies are commonly consumed in soups, stir-fries, salads, and other traditional dishes because of their delicate texture and mild flavor. In several Asian countries, *F. velutipes* is also regarded as

a health-promoting food and has been traditionally consumed to improve general well-being and support immune function. These ethnomycological practices are consistent with contemporary pharmacological studies demonstrating antioxidant, immunomodulatory, antimicrobial, and anticancer activities (Wasser, 2014; Sharma & Kumar, 2023), highlighting the close relationship between traditional dietary use and modern biomedical research.

***Fomes fomentarius* (L.) Fr., Summa vegetabilium Scandinaviae 2: 237 (1849) [MB#194860] (Table 2, Fig. 4E)**

Morphological description. *F. fomentarius*, commonly known as the tinder fungus, is a perennial wood-decaying basidiomycete producing large, sessile, hoof-shaped basidiomata. The upper surface is hard, gray to brown, concentrically zoned, and often cracked with age. The context is corky to woody, while the hymenophore is poroid with small, round pores (4-6 per mm). The hyphal system is trimitic, consisting of generative, skeletal, and binding hyphae. Basidia are clavate with four sterigmata, and basidiospores are smooth, hyaline, cylindric to ellipsoid, measuring $10-14 \times 4-5 \mu\text{m}$ (Bernicchia & Gorjón, 2020; Dai, 2010).

Distribution and habitat in the Nurata Range. *F. fomentarius* is a widespread species distributed throughout the temperate and boreal regions of Europe, Asia, and North America. It primarily colonizes dead or weakened hardwoods, particularly species of *Juglans*, *Fagus*, and *Betula*, causing white rot and occasionally acting as a weak pathogen on stressed trees. In the Nurata Ridge, it is most frequently observed on *Juglans regia*, where it contributes to wood decomposition and nutrient cycling within forest ecosystems (Bernicchia & Gorjón, 2020).

Bioactive compounds and medicinal potential. *F. fomentarius* contains numerous bioactive constituents, including polysaccharides, phenolic compounds, terpenoids, and other secondary metabolites with documented pharmacological activities. Extracts of the fruiting bodies exhibit antioxidant, antimicrobial, anti-inflammatory, and immunomodulatory properties, while polysaccharide fractions have demonstrated hepatoprotective effects in experimental studies (Dai, 2010; Wasser, 2014). These biological activities suggest considerable potential for the development of functional foods, nutraceuticals, and natural therapeutic agents.

Ethnomycological records in the Nurata Range. No traditional medicinal use of *F. fomentarius* was documented among local communities of the Nurata Range during the present study. However, the species has a long history of ethnomycological use in Europe and Asia, where its fruiting bodies were traditionally employed as tinder for fire-making and as wound dressings because of their absorbent and antimicrobial properties. These traditional applications are supported by modern pharmacological studies demonstrating antimicrobial, antioxidant, and anti-inflammatory activities, highlighting the medicinal potential of this species (Bernicchia & Gorjón, 2020; Wasser, 2014).

***Ganoderma applanatum* (Pers.) Pat., Bull. Soc. Mycol. France 5: 67 (1889) [MB#119872] (Table 2, Fig. 6C)**

Morphological description. *G. applanatum* is a perennial wood-decaying polypore producing large, sessile, flat to hoof-shaped basidiomata with a hard, corky to woody texture. The upper surface is dark brown to grayish-black, concentrically zoned, and often covered with brown spore deposits at maturity. The pore surface is initially white, becoming brown with age or when bruised, with 4-6 round pores per mm. The context is dense and cork-like. Microscopically, the species possesses a trimitic hyphal system and double-walled, brown, ovoid basidiospores, characteristic of the genus *Ganoderma* (Tsilvelva *et al.* 2018).

Distribution and habitat in the Nurata Range. *G. applanatum* is a widespread white-rot fungus distributed throughout temperate regions of Europe, Asia, and North America. It occurs primarily on dead or declining hardwood trees, including species of *Fagus*, *Quercus*, *Acer*, and *Juglans*, where it causes extensive lignin degradation. In the Nurata Range, the species was recorded on standing dead trees, stumps, and fallen logs in deciduous forests, functioning mainly as a saprotroph and occasionally as a weak parasite on stressed hosts (Pawłowicz *et al.* 2024).

Bioactive compounds and medicinal potential. *G. applanatum* contains numerous biologically active compounds, including polysaccharides, triterpenoids, phenolic compounds, flavonoids, alkaloids, and other secondary metabolites. These constituents exhibit antioxidant, antimicrobial, anti-inflammatory, and immunomodulatory activities. Polysaccharide and exopolysaccharide fractions have demonstrated cytotoxic and antiproliferative effects against several cancer cell lines while enhancing immune responses, indicating potential applications in functional foods, nutraceuticals, and complementary medicine (Tsilvelva *et al.* 2018; Rijia *et al.* 2024).

Ethnomycological records in the Nurata Range. No traditional use of *G. applanatum* was documented among local communities of the Nurata Range during the present study. However, the species has long been utilized in Europe and East Asia for both medicinal and cultural purposes. In traditional medicine, decoctions and extracts have been used to alleviate

inflammatory disorders and to promote general health because of their immunomodulatory properties. Owing to its white pore surface, which permanently darkens when scratched, the fungus is also widely known as the “Artist's Conk” and has traditionally been used as a natural drawing medium. In addition, the basidiomata have been processed into amadou, a durable material historically employed for fire-starting and other practical applications (Molitoris, 1994; Davis *et al.* 2012; Sundström, 2021). These diverse traditional uses are consistent with contemporary pharmacological studies, highlighting *G. applanatum* as both a culturally important and medicinally valuable macrofungus.

***Ganoderma resinaceum* Boud., Bull. Soc. Mycol. France 5: 72 (1889) [MB#123196] (Table 2, Fig. 6B)**

Morphological description. *G. resinaceum* is an annual wood-decaying polypore producing stipitate to laterally attached basidiomata with a characteristic laccate, reddish- to dark brown pileus. Fruiting bodies are thick and corky, with a smooth to slightly wrinkled upper surface and a rounded, pale ochraceous margin. The hymenophore is white to pale brown, bearing circular pores (2-6 per mm) that darken with age. The context is light brown and woody. Microscopically, the species possesses a trimitic hyphal system and thick-walled, brown, double-walled basidiospores measuring $9-13 \times 5-8 \mu\text{m}$, typical of the genus *Ganoderma* (Fryssouli *et al.* 2020).

Distribution and habitat in the Nurata Range. *G. resinaceum* is widely distributed throughout temperate and Mediterranean regions of Europe and also occurs in parts of Asia and Africa. It grows as a saprotroph or weak parasite on living, declining, or dead hardwoods, particularly species of *Quercus*, *Salix*, and other deciduous trees. In the Nurata Range, the species was recorded on *Salix alba* L. growing along a stream near the ancient settlement of Majdrum, adjacent to the *Biota orientalis* natural heritage area. This record represents one of the few confirmed occurrences of *G. resinaceum* in Uzbekistan and reflects its preference for moist riparian habitats with mature woody hosts (Islomiddinov *et al.* 2023; Fryssouli *et al.* 2020).

Bioactive compounds and medicinal potential. *G. resinaceum* contains a diverse array of triterpenoids, meroterpenoids, polysaccharides, and other secondary metabolites with significant pharmacological potential. Recent studies have identified several novel triterpenoids, including ganoresinoids, which exhibit pronounced anti-inflammatory, antioxidant, and anti-apoptotic activities through the regulation of NF- κ B, MAPK, and Nrf2 signaling pathways. These compounds suppress oxidative stress, inhibit the production of pro-inflammatory cytokines, and protect cells against apoptosis, suggesting potential applications in the prevention and treatment of inflammatory, neurodegenerative, and oxidative stress-related disorders. Additional investigations have demonstrated dermatoprotective effects through the attenuation of UV-induced cellular damage, highlighting the species as a promising source of bioactive compounds for functional foods and pharmaceutical development (Kou *et al.* 2022; Zhang *et al.* 2026).

Ethnomycological records in the Nurata Range. No traditional use of *G. resinaceum* was recorded among local communities of the Nurata Range during the present study. Nevertheless, the species has been recognized in European and Asian folk medicine as a regional counterpart of the medicinal *Ganoderma* species, particularly *G. lucidum*. Although less frequently utilized than Lingzhi, fruiting bodies have occasionally been prepared as decoctions and herbal extracts intended to promote general health and vitality. In recent years, *G. resinaceum* has attracted increasing attention in ethnomycological and phytotherapeutic studies because of its medicinal potential and its role in preserving traditional knowledge associated with wild medicinal fungi (Ulbricht *et al.* 2010; Hapuarachchi *et al.* 2016).

***Inonotus hispidus* (Bull.) P. Karst., Meddeland. Soc. Fauna Fl. Fenn. 5: 39 (1879) [MB#100985] (Table 2, Fig. 6A)**

Morphological description. *I. hispidus* is an annual wood-decaying polypore producing large, sessile, semicircular to applanate basidiomata with a soft, spongy texture when fresh and becoming hard and brittle upon drying. The upper surface is densely hispid to hirsute, reddish-orange in young specimens, gradually darkening to reddish-brown or blackish with age. The pore surface is yellowish to olivaceous-brown, becoming dark brown at maturity, with angular pores (1-3 per mm). The context is thick, reddish-brown, and turns black in potassium hydroxide (KOH). The hyphal system is monomitic, and basidiospores are smooth, yellowish-brown, ellipsoid to broadly ellipsoid (Ryvarden & Melo, 2017; Dai, 2012).

Distribution and habitat in the Nurata Range. *Inonotus hispidus* is widely distributed throughout temperate regions of Europe, Asia, and North America, where it occurs as a parasite and later as a saprotroph on deciduous hardwoods, causing white rot. In the Nurata Range, the species is commonly found on living and weakened trees of *Juglans* and *Morus*, as well as other broadleaved hosts. Fruiting bodies develop on trunks and large branches in forests, orchards, gardens, and parklands, reflecting the species' adaptability to both natural and anthropogenic habitats (Bernicchia & Gorjón, 2010; Mustafayev *et al.* 2025).

Bioactive compounds and medicinal potential. *I. hispidus* contains a variety of biologically active compounds, including polysaccharides, phenolic compounds, flavonoids, and terpenoids with demonstrated pharmacological activities. Extracts exhibit strong antioxidant properties through efficient free-radical scavenging and reducing capacities. In addition, antimicrobial activity has been reported against several pathogenic microorganisms, including *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. Polysaccharide-rich fractions have also shown antiproliferative and immunomodulatory effects by inhibiting cancer cell growth and stimulating immune responses, indicating promising applications in functional foods, nutraceuticals, and complementary medicine (Liu *et. al.* 2018; Zhang *et. al.* 2021).

Ethnomycological records in the Nurata Range. Interviews conducted during the present study revealed that *Inonotus hispidus*, locally known as “Pukak”, has traditionally been used by local communities of the Nurata Range as a natural dye. Fruiting bodies were processed to obtain brown and ochre pigments for coloring wool and cotton yarn used in traditional handicrafts. Similar uses of wood-decaying polypores have been documented in Eastern Europe and East Asia, where species of *Fomes*, *Phellinus*, and *Ganoderma* were employed for dyeing textiles and leather (Chang & Miles, 2004; Stamets, 2005). These cross-cultural similarities demonstrate that *I. hispidus* has served not only as a medicinal resource but also as an important component of traditional material culture, highlighting its ethnomycological significance and potential value for sustainable natural dye production.

***Laetiporus sulphureus* (Bull.) Murrill, Mycologia 12 (1): 11 (1920) [MB#299348] (Table 2, Fig. 6D)**

Morphological description. *L. sulphureus*, commonly known as the sulphur shelf or chicken-of-the-woods, is a conspicuous annual wood-decaying polypore producing large, overlapping, fan-shaped to semicircular basidiomata. Fruiting bodies are sessile to shortly stipitate, bright yellow to orange when young, with a sulfur-yellow pore surface and white spore print. The basidiomata are soft and fleshy when fresh, becoming brittle and fragile with age. The context is white to pale yellow, and pores are small and angular, characteristic of the genus *Laetiporus* (Adamska, 2023).

Distribution and habitat in the Nurata Range. *L. sulphureus* is a widely distributed wood-decaying fungus occurring throughout temperate regions of Europe, Asia, and North America. It primarily inhabits weakened or dead hardwoods, especially species of *Quercus*, *Salix*, *Populus*, *Prunus*, and *Acer*, where it causes brown rot and contributes to lignocellulose decomposition and nutrient cycling. In the Nurata Range, the species is widespread and was recorded on *Salix*, *Populus*, *Juglans*, and *Prunus* trees, particularly in riparian habitats, orchards, and mixed woodland ecosystems. Its frequent occurrence reflects its broad ecological tolerance and ability to colonize diverse woody substrates (Nepal *et. al.* 2024).

Bioactive compounds and medicinal potential. *L. sulphureus* contains a variety of biologically active compounds, including polysaccharides, triterpenoids, phenolic compounds, and other secondary metabolites. Extracts and isolated fractions have demonstrated antioxidant, antimicrobial, anti-inflammatory, immunomodulatory, and cytoprotective activities. Polysaccharide components are associated with immune regulation and antioxidant defense, while phenolic and terpenoid compounds contribute to antimicrobial and anti-inflammatory effects. These properties support the potential use of *L. sulphureus* as a functional food and source of natural compounds for nutraceutical and pharmaceutical applications (Adamska, 2023; Sulkowska-Ziaja & Muszyńska, 2018).

Ethnomycological records in the Nurata Range. Interviews conducted during the present study did not reveal specific traditional medicinal applications of *L. sulphureus* among local communities of the Nurata Range. However, the species has a long history of ethnomycological use as both an edible and medicinal mushroom in Europe and Asia. Young, tender fruiting bodies are traditionally collected and consumed as a meat substitute, while dried powders, extracts, and decoctions have been used in folk medicine for gastrointestinal disorders, fever, respiratory complaints, and inflammatory conditions. Similar applications have been documented in Himalayan communities, where dried mushroom preparations are used to alleviate digestive problems and bleeding disorders (Nepal *et. al.* 2024). The combination of traditional knowledge and modern pharmacological evidence highlights *L. sulphureus* as an ecologically important and culturally valuable medicinal macrofungus with potential applications in functional foods and natural therapeutics.

***Lentinus brumalis* (Pers.) Zmitr., Int. J. Med. Mushr. 12 (1): 88 (2010) [MB#543133] (Table 2, Fig. 6E)**

Morphological description. *L. brumalis* is an annual lignicolous basidiomycete producing centrally to eccentrically stipitate, leathery basidiomata. The pileus is circular to slightly depressed, 2-8 cm in diameter, with a dry, light brown to grayish-brown surface often covered by fine scales. The margin is thin and slightly incurved when young. The hymenophore is poroid to daedaloid, with elongated radial pores forming a characteristic maze-like pattern. The stipe is slender, fibrous, and darker

toward the base. Basidiospores are smooth, hyaline, cylindrical to ellipsoid. These features reflect its adaptation to decomposition of woody substrates (Ryvarden & Melo, 2014; Bernicchia & Gorjón, 2010).

Distribution and habitat in the Nurata Range. *L. brumalis* is widely distributed in temperate regions of Europe, Asia, and North America, where it develops on dead hardwood branches, logs, and other lignocellulosic substrates. In the Nurata Range, the species has been recorded on decaying woody materials, including stems of *Artemisia* spp. and other plant residues. As a saprotroph, it contributes to lignocellulose degradation, organic matter turnover, and nutrient cycling in semi-arid mountain ecosystems (Ryvarden & Melo, 2014; Islomiddinov *et al.* 2023).

Bioactive compounds and medicinal potential. Although *L. brumalis* has received limited direct pharmacological investigation, species within the genus *Lentinus* are known to produce polysaccharides, phenolic compounds, and terpenoid metabolites with antioxidant, antimicrobial, and immunomodulatory activities. These compounds have attracted interest for their potential applications in nutraceutical and pharmaceutical research (Wasser, 2014; Chang & Miles, 2004). Further studies are required to evaluate the specific medicinal properties of *L. brumalis*.

Ethnomycological records in the Nurata Range. No direct medicinal or culinary use of *L. brumalis* was documented among local communities of the Nurata Range. However, its ecological importance as a wood-decaying fungus is recognized through traditional knowledge of wild mushroom diversity. By decomposing woody plant material, the species contributes to ecosystem functioning and reflects the diversity of lignicolous fungi associated with mountain environments.

***Lentinus tigrinus* (Bull.) Fr., Systema Orbis Vegetabilis 1: 78 (1825) [MB#164542] (Table 2, Fig. 6F)**

Morphological description. *L. tigrinus* is a lignicolous basidiomycete characterized by its distinctive scaly pileus and lamellate hymenophore. The pileus is 3-10 cm in diameter, initially convex and becoming plano-convex or slightly depressed at maturity. The surface is whitish to pale brown with dark brown scales forming a tiger-like pattern. Lamellae are crowded, narrow, and strongly decurrent, white to cream in color. The stipe is central to slightly eccentric, cylindrical, fibrous, and often scaly, measuring 3-8 × 0.5-1.5 cm. The flesh is white and firm, while basidiospores are smooth, cylindrical to ellipsoid, approximately 5-8 × 2-3 µm. The hyphal system is dimitic, consisting of generative and skeletal hyphae, contributing to the tough texture of mature basidiomata (Petersen & Hughes, 2010; Justo *et al.* 2017).

Distribution and habitat in the Nurata Range. *L. tigrinus* is a widely distributed wood-decaying fungus occurring in temperate and subtropical regions of Europe, Asia, North America, South America, and Africa. It primarily inhabits dead hardwood logs, branches, and stumps, particularly of *Populus*, *Salix*, and other deciduous trees. In the Nurata Range, the species occurs on decaying hardwood substrates, including riparian habitats and forest edges. As a white-rot fungus, it plays an important ecological role in lignin degradation, nutrient cycling, and decomposition processes within forest ecosystems (Kirk *et al.* 2008).

Bioactive compounds and medicinal potential. *L. tigrinus* produces various biologically active compounds, including polysaccharides, phenolic compounds, and secondary metabolites with antioxidant and antimicrobial properties. Although its pharmacological potential remains less studied than that of other medicinal mushrooms, extracts have demonstrated biological activity in laboratory investigations. Related *Lentinus* species possess immunomodulatory and antitumor polysaccharides, suggesting potential medicinal value for *L. tigrinus* as well (Wasser, 2002; Wasser, 2014). The species is also an important producer of ligninolytic enzymes, including laccases and peroxidases, which have applications in biotechnology and bioremediation (Pointing, 2001).

Ethnomycological records in the Nurata Range. Interviews conducted during the present study revealed that *Lentinus tigrinus* is locally recognized as an edible wild mushroom in the Nurata Range. Local inhabitants collect young, fresh fruiting bodies for consumption and occasional local trade. Because mature basidiomata become tough and fibrous, only young specimens are preferred as food. Similar edible uses of *L. tigrinus* have been reported from several regions of Asia and Africa, where local communities collect and prepare young fruiting bodies after cooking (Boa, 2004). The continued collection of this species in the Nurata Range demonstrates its importance as a seasonal food resource and highlights the role of traditional knowledge in documenting edible fungal diversity.

***Phallus impudicus* L., Species Plantarum 2: 1179 (1753) [MB#245934] (Table 2, Fig. 7A)**

Morphological description. *Ph. impudicus* is a saprotrophic gasteroid basidiomycete characterized by a distinctive stinkhorn-type fruiting body. The basidioma develops from an egg-like structure and rapidly forms a hollow, cylindrical receptacle,

usually 10-25 cm high, with a white spongy stalk. The upper part bears a conical head covered by an olive-green mucilaginous gleba with a strong unpleasant odor that attracts insects for spore dispersal. The volva remains as a white sac-like structure at the base. Basidiospores are small, smooth, ellipsoid, and hyaline (Breitenbach & Kränzlin, 1984; Pegler *et al.* 1995).

Distribution and habitat in the Nurata Range. *Ph. impudicus* is a widely distributed saprotrophic fungus occurring in temperate regions of Europe, Asia, and North America. It commonly inhabits nutrient-rich soils in deciduous and mixed forests, gardens, and areas with abundant organic matter, where it contributes to the decomposition of plant residues and nutrient cycling (Pegler *et al.* 1995; Kirk *et al.* 2008).

Fruiting bodies usually appear during humid periods when sufficient soil moisture promotes fungal development. In the Nurata Range, *Ph. impudicus* has been recorded mainly in walnut (*Juglans regia*) forests located near stream valleys. The species develops on humus-rich soils with accumulated organic material under relatively moist microhabitats. Its occurrence in riparian walnut forests demonstrates the importance of local environmental conditions, particularly soil humidity and organic matter availability, for the establishment of this species within the semi-arid mountain landscape.

Bioactive compounds and medicinal potential. Although *Ph. impudicus* is not among the most extensively studied medicinal mushrooms, several studies on stinkhorn fungi have reported the presence of biologically active compounds, including polysaccharides, phenolic compounds, and other secondary metabolites with antioxidant and immunomodulatory properties. These compounds indicate potential value for functional food and natural product research (Wasser, 2014). However, compared with medicinally well-established taxa such as *Ganoderma* spp., *Trametes versicolor*, and *Inonotus* spp., the pharmacological potential of *Ph. impudicus* remains insufficiently investigated, and further biochemical and biological studies are required.

Ethnomycological records in the Nurata Range. *Ph. impudicus* has been documented in some traditional European and Asian medicinal practices, where stinkhorn fungi have occasionally been used in folk remedies. However, its cultural importance and utilization vary considerably among regions, and it is not generally recognized as a major edible or medicinal species (Hobbs, 2002; Wasser, 2010).

According to field observations and interviews conducted in the Nurata Range, local communities are unfamiliar with *P. impudicus* and do not use this species for food, medicine, or other traditional purposes. The strong odor of mature fruiting bodies and its unusual appearance may contribute to the absence of local acceptance. The lack of ethnomycological knowledge regarding this species highlights the importance of documenting fungal diversity and understanding patterns of traditional recognition and utilization of wild macrofungi in the Nurata Range.

***Phellinus igniarius* (L.) Quél., Enchiridion Fungorum in Europa media et praesertim in Gallia Vigentium: 172 (1886) [MB#120661] (Table 2, Fig. 7D)**

Morphological description. *Ph. igniarius* is a perennial wood-decaying polypore producing large, woody, hoof-shaped to ungulate basidiomata that may persist for many years. The upper surface is dark brown to gray-black, crusty, concentrically zoned, and often deeply fissured. The hymenophore is poroid, with brown to reddish-brown pores (4-6 per mm). The context is very hard, woody, and reddish-brown, with stratified tube layers. The hyphal system is dimitic, consisting of thin-walled generative hyphae and thick-walled skeletal hyphae. Basidiospores are thick-walled, subglobose to broadly ovoid, measuring approximately $5-6.5 \times 4.5-6 \mu\text{m}$ (Bernicchia & Gorjón, 2020; He *et al.* 2021).

Distribution and habitat in the Nurata Range. *Ph. igniarius* is a widespread perennial polypore distributed throughout temperate regions of Europe and Asia. It primarily colonizes living and weakened hardwood trees, later continuing its development on dead wood, where it causes white rot. The species has been reported from hosts including *Acer*, *Juglans*, *Lonicera*, and *Salix*. In the Nurata Range, it occurs on broadleaved trees such as *Morus*, *Prunus*, and *Juglans* particularly in riparian habitats, orchards, and forest margins. Its persistent woody basidiomata allow long-term survival under fluctuating environmental conditions and contribute to lignocellulose decomposition (Badalyan & Gharibyan, 2020; Bernicchia & Gorjón, 2020).

Bioactive compounds and medicinal potential. *Ph. igniarius* is considered a valuable medicinal fungus due to its rich content of polysaccharides, phenolic compounds, and terpenoids. These metabolites exhibit antioxidant, anticancer, antiviral, antiangiogenic, and immunomodulatory activities. Several studies have identified bioactive triterpenoids, including cardioprotective 22-hydroxylanostane derivatives, supporting its potential role in cardiovascular protection. Polysaccharide

fractions demonstrate antioxidant activity and immune regulation, indicating potential applications in nutraceuticals, functional foods, and complementary medicine (Sulowska-Ziaja *et. al.* 2022; He *et. al.* 2021; Li *et. al.* 2021).

Ethnomycological records in the Nurata Range. No specific medicinal use of *Ph. igniarius* was documented among local communities of the Nurata Range during the present study. However, the species has a long history of ethnomedicinal application in Eurasia and among indigenous communities. Traditional preparations, including decoctions, teas, and tinctures, have been used for digestive disorders, inflammation, liver protection, and general health maintenance. In some northern cultures, the fungus was consumed as a boiled preparation for stomach complaints, while burned material was occasionally mixed with tobacco to enhance nicotine absorption. Contemporary ethnomycological studies continue to recognize *Ph. igniarius* as an important medicinal polypore due to the connection between traditional applications and its experimentally confirmed antioxidant and pharmacological properties (Blanchette *et. al.* 2002; Meunink, 2015; Badalyan & Gharibyan, 2020).



Figure 7. A - *Inonotus hispidus*, B - *Ganoderma resinaceum*, C - *Ganoderma applanatum*, D - *Laetiporus sulphureus*, E - *Lentinus tigrinus*, F - *Lentinus brumalis*. Photo credit by Ilyor Mustafaev.

***Pleurotus eryngii* (DC.) Qué., Mém. Soc. Émul. Montbéliard Ser. 2, 5: 112 (1872) [MB#170772] (Table 2, Fig. 7C)**

Morphological description. *P. eryngii*, commonly known as the king oyster mushroom, is a saprotrophic to weakly parasitic agaricoid basidiomycete producing solitary to clustered, fleshy basidiomata. The pileus is typically convex to depressed, 4-15 cm in diameter, smooth, and variable in color from white to grayish-brown. Lamellae are white to cream, crowded, and strongly decurrent onto the stipe. The stipe is well-developed, cylindrical to slightly enlarged, white, firm, and often central

or eccentric. The flesh is thick, compact, and white with a mild odor and pleasant taste. Basidiospores are smooth, cylindrical to ellipsoid, and hyaline, characteristic of the genus *Pleurotus*.

Distribution and habitat in the Nurata Range. *P. eryngii* is widely distributed in temperate regions of Europe, Asia, and North Africa, where it is ecologically associated with herbaceous plants of the family Apiaceae. Unlike most *Pleurotus* species, it develops primarily on the underground parts and roots of host plants, including species of *Ferula*, where it acts mainly as a saprotroph and occasionally as a weak parasite. In Uzbekistan, including the Nurata Range, fruiting bodies appear mainly during spring in mountainous and semi-arid habitats at elevations of approximately 1000-2500 m. The species is frequently associated with *Ferula* spp. growing in steppe and mountain ecosystems, where it contributes to organic matter decomposition and nutrient cycling.

Bioactive compounds and medicinal potential. *P. eryngii* is considered a valuable edible and medicinal mushroom due to its rich content of bioactive compounds, including polysaccharides, phenolic compounds, sterols, and other secondary metabolites. Studies have demonstrated antioxidant, antimicrobial, anti-inflammatory, hypoglycemic, and immunomodulatory activities of its extracts. Polysaccharide fractions, particularly β -glucans, have been associated with immune regulation and potential antidiabetic effects through modulation of glucose metabolism. These properties support the use of *P. eryngii* as a functional food and a promising source of nutraceutical compounds (Wasser, 2014).

Ethnomycological records in the Nurata Range. Interviews conducted during the present study revealed that *P. eryngii* is one of the most valued edible wild mushrooms among mountain communities of Uzbekistan. Locally known as “Chanbush” or “White desert mushroom” it is traditionally collected in spring and prepared as a seasonal food. Fresh fruiting bodies are commonly chopped and fried with oil and onion, while dried mushrooms are rehydrated and incorporated into traditional dishes. Local inhabitants also attribute medicinal properties to this mushroom, particularly its potential role in managing diabetes. These culinary practices and local health beliefs demonstrate the significant nutritional and cultural importance of *P. eryngii* within the ethnomycological traditions of Uzbekistan.

***Pleurotus ostreatus* (Jacq.) P. Kumm., Führer Pilzk.: 105 (1871) [MB#174220] (Table 2, Fig. 7B)**

Morphological description. *P. ostreatus*, commonly known as the oyster mushroom, is a saprotrophic agaricoid basidiomycete producing large, fleshy, fan-shaped basidiomata. The pileus is 4-15(-25) cm in diameter, semicircular to spatulate, initially convex and later expanded, with a smooth to finely pubescent surface. The cap color varies from grayish-brown and beige to whitish with age. Lamellae are crowded, broad, white to pale pinkish, and strongly decurrent. The stipe is absent or short, lateral to eccentric, firm, and whitish. The flesh is thick, white, and slightly fibrous. Basidiospores are smooth, cylindrical to ellipsoid, and hyaline, typical of the genus *Pleurotus*.

Distribution and habitat in the Nurata Range. *P. ostreatus* is a cosmopolitan wood-decaying fungus distributed throughout temperate regions worldwide except Arctic ecosystems. It commonly develops in clusters on dead or weakened hardwoods, including *Salix*, *Populus*, *Betula*, *Acer*, and *Morus*, where it causes white rot and contributes to lignocellulose decomposition. In the Nurata Range, the species is frequently observed on trunks and branches of willow, poplar, and mulberry trees, particularly along streams, riversides, and moist habitats. Its ability to colonize various woody substrates enables it to persist in both natural and human-modified environments.

Bioactive compounds and medicinal potential. *P. ostreatus* is one of the most extensively studied medicinal and edible mushrooms. It contains bioactive polysaccharides, β -glucans, phenolic compounds, sterols, and other metabolites with antioxidant, antimicrobial, immunomodulatory, hypocholesterolemic, and anticancer activities. Polysaccharide fractions have demonstrated immune-stimulating effects, while extracts show potential in reducing oxidative stress and supporting metabolic health. These properties have contributed to its widespread use as a functional food and nutraceutical resource (Wasser, 2014).

Ethnomycological records in the Nurata Range. Local communities of the Nurata Range recognize *P. ostreatus* as a valuable edible wild mushroom. Fruiting bodies are collected from willow, poplar, and mulberry trees during the favorable season and prepared as a traditional food. Local people commonly fry chopped mushrooms with oil and onion, sometimes adding potatoes or eggs to prepare a seasonal dish. The continued collection and consumption of *P. ostreatus* demonstrate its importance in local food traditions and the ethnomycological knowledge associated with edible wood-inhabiting fungi.

***Schizophyllum commune* Fr., Observ. mycol. (Havniae) 1: 103 (1815) [MB#209040] (Table 1)**

Morphological description. *S. commune* is a widespread basidiomycete fungus known as the split-gill mushroom. The fruiting bodies (basidiomata) are small (1-4 cm wide), tough, fan- or shell-shaped, whitish to greyish, and densely hairy. A defining character is its split gills (lamellae), which divide longitudinally and fold back during dry conditions to protect the hymenium, reopening upon rehydration. Microscopically, it features a monomitic hyphal system with clamp connections, tetrasporic basidia, and smooth, hyaline, cylindrical to ellipsoid basidiospores. This xerotolerant adaptation allows *S. commune* to survive extended periods of desiccation in forest environments (Wasser, 2011; Stalpers, 1988).

Distribution and habitat in the Nurata Range. *S. commune* is a cosmopolitan species found across temperate, tropical, and subtropical regions worldwide. It acts primarily as a saprotrophic or weakly parasitic fungus, colonizing dead or decaying wood of broadleaf trees, including fallen logs, dead branches, and stumps. The species plays an active role in early-to-intermediate stages of wood decay and lignocellulose breakdown. In the Nurata Range, *S. commune* has been documented in diverse habitats, ranging from mountain broadleaf forest remnants to riparian zones and managed orchards, predominantly on fallen branches of *Prunus*, *Juglans*, *Populus*, and *Malus* species. Its high tolerance to sunlight and desiccation enables it to thrive in the relatively open and exposed terrain of the mountain slopes.

Bioactive compounds and medicinal potential. *S. commune* produces several valuable bioactive compounds, most notably the extracellular neutral beta-glucan polysaccharide known as schizophyllan (sizofiran). Schizophyllan has been extensively studied for its potent immunomodulatory, antitumor, and anti-inflammatory activities, and it has been utilized clinically as an adjuvant in cancer immunotherapy. In addition, extracts of *S. commune* exhibit strong antioxidant and antimicrobial properties against various fungal and bacterial pathogens. These pharmaceutical characteristics make *S. commune* a significant focus in biotechnology, nutraceutical research, and the development of immune-boosting agents (Giavasis, 2013; Zhong *et al.* 2013).

Ethnomycological records in the Nurata Range. No specific traditional medicinal or culinary uses of *S. commune* were recorded among the local populations of the Nurata Range during the current field investigations, where it is generally overlooked due to its tough and leathery texture. However, global ethnomycological records indicate that *S. commune* is consumed as a food source in parts of Tropical Africa, Southeast Asia, and Central America, where its chewy texture is valued. Modern pharmacological findings validate its traditional recognition in various indigenous cultures as a health-restoring organism. Documenting *S. commune* in the Nurata Range enriches the regional inventory of macromycetes and highlights its ecological and biotechnological significance.

***Stropharia coronilla* (Bull.) Qué., Mém. Soc. Émul. Montbéliard Ser. 2, 5: 255 (1872) [MB#232954] (Table 2, Fig. 7E)**

Morphological description. *S. coronilla* is a medium-sized agaricoid basidiomycete producing fleshy fruiting bodies with a convex to flattened pileus. The cap is 3-8 cm in diameter, smooth, pale yellow to straw-colored, and may become slightly viscid under moist conditions. Lamellae are moderately crowded, adnate to adnexed, changing from grayish to dark purplish-brown as spores mature. The stipe is cylindrical, whitish to pale yellow, and bears a persistent annulus. Basidiospores are ellipsoid, smooth, thick-walled, and produce a dark purple-brown spore print. The species has a monomitic hyphal system with clamp connections (Arora, 1986; Noordeloos, 2011).

Distribution and habitat in the Nurata Range. *S. coronilla* is widely distributed in temperate regions of Europe, Asia, and North America. It is a saprotrophic species occurring mainly in grasslands, meadows, pastures, and other habitats with organic-rich soils. In the Nurata Range, it is commonly found in open meadow ecosystems, especially near streams and riparian areas where soil moisture and organic matter accumulation favor fruiting. Basidiomata usually appear in groups after seasonal rainfall.

Bioactive compounds and medicinal potential. Although direct pharmacological studies on *S. coronilla* are limited, species of the genus *Stropharia* contain various secondary metabolites, including phenolic compounds and polysaccharides, which are associated with antioxidant and antimicrobial activities. These findings indicate potential value for future studies on functional foods and natural bioactive compounds (Wasser, 2014).

Ethnomycological records in the Nurata Range. During ethnomycological surveys, *S. coronilla* was recognized by local communities as an edible wild mushroom. Fruiting bodies are collected mainly during spring in meadow habitats and consumed after cooking. In some rural areas, the species is occasionally traded in local markets as a seasonal edible mushroom. Its use reflects the role of grassland fungi as supplementary food resources within traditional mushroom-gathering practices.



Figure 7. A - *Phallus impudicus*, B - *Pleurotus ostreatus*, C - *Pleurotus eryngii*, D - *Phellinus igniarius*, E - *Stropharia coronilla*. Photo credit by Ilyor Mustafaev.

***Trametes versicolor* (L.) Lloyd, Mycol. Writ. 6 (65): 1045 (1920) [MB#281625] (Table 2, Fig. 8B)**

Morphological description. *T. versicolor*, commonly known as turkey tail, is a perennial to annual white-rot polypore producing thin, leathery, and semicircular basidiomata arranged in overlapping clusters. The pileus is fan-shaped, concentrically zoned, and displays variable colors including gray, brown, cream, and reddish tones. The upper surface is finely tomentose, while the hymenophore is poroid with small, round pores (approximately 3-5 per mm). The fruiting bodies are sessile and firmly attached to woody substrates. The context is thin, tough, and white to pale brown, reflecting its adaptation to long-term growth on decaying wood (Zhang *et. al.* 2021).

Distribution and habitat in the Nurata Range. *T. versicolor* is a cosmopolitan wood-decaying fungus widely distributed in temperate and subtropical regions of Europe, Asia, and North America. It primarily grows on dead hardwood logs, stumps, and branches, where it causes white rot through enzymatic degradation of lignin and cellulose. In the Nurata Range, the species is frequently recorded on decaying woody substrates, including *Populus*, *Crataegus*, *Prunus*, and *Acer* species, particularly in riparian forests and forest-edge habitats.

Bioactive compounds and medicinal potential. *T. versicolor* is one of the most extensively studied medicinal polypore fungi due to its immunologically active polysaccharopeptides, particularly polysaccharide-K (PSK) and polysaccharopeptide (PSP). These compounds exhibit immunomodulatory, antioxidant, antimicrobial, and antitumor activities. Studies have demonstrated that PSK and PSP can stimulate immune responses by activating macrophages, T-lymphocytes, and cytokine production. PSK is used as an adjunct therapeutic agent in cancer treatment in Japan and China, particularly to support immune function during chemotherapy. These findings highlight *T. versicolor* as an important source of bioactive compounds with potential applications in medicine, nutraceuticals, and functional foods (Zhang *et. al.* 2021; Jing *et. al.* 2022).

Ethnomycological records in the Nurata Range. No specific traditional medicinal application of *T. versicolor* was documented among local communities of the Nurata Range during the present study. However, the species has a long history of use in East Asian traditional medicine, where it is known as “Yun Zhi” and has been prepared as decoctions and aqueous extracts to strengthen immunity and support general health. These traditional uses align with modern findings on the immunostimulatory and antioxidant polysaccharides of *T. versicolor*, underscoring its dual role as a decomposer and biomedical resource (Zhang *et. al.* 2021).

***Tremella mesenterica* Retz., Kongl. Vetensk. Acad. Handl. ser. 1, 30: 249 (1769) [MB#154470] (Table 2, Fig. 8E)**

Morphological description. *T. mesenterica* is a gelatinous basidiomycete commonly known as the yellow brain mushroom. The fruiting bodies are soft, translucent, and yellow to orange in color, forming irregular lobes and convoluted structures resembling a brain or sponge. Basidiomata are usually a few centimeters in size and become shriveled and darker when dry, recovering their gelatinous texture after moisture absorption. Microscopically, the species possesses hyaline, septate hyphae and longitudinally septate basidia with four sterigmata. Basidiospores are smooth, ellipsoid to ovoid, and hyaline. The gelatinous structure enables the fungus to survive fluctuations in moisture availability, which is characteristic of wood-inhabiting jelly fungi (Pippola & Kotiranta, 2008; Hsu *et. al.* 2006).

Distribution and habitat in the Nurata Range. *T. mesenterica* is widely distributed in temperate and subtropical regions of Europe, Asia, and North America. It occurs mainly on dead branches, twigs, and logs of broadleaf trees, where it participates in wood decomposition. The species is associated with decaying hardwood substrates and commonly appears during humid periods, particularly in autumn and winter. In the Nurata Range, it has been recorded on decaying woody materials in forested areas and riparian habitats, where suitable moisture conditions support the development of its gelatinous fruiting bodies. As a saprotrophic fungus, it contributes to lignocellulose degradation and nutrient cycling within forest ecosystems.

Bioactive compounds and medicinal potential. *T. mesenterica* contains biologically active polysaccharides, particularly acidic glucuronoxylomannan compounds, which have demonstrated immunomodulatory and antioxidant activities. Experimental studies have shown that extracts from fruiting bodies and mycelial biomass can stimulate immune responses, enhance leukocyte and splenocyte activity, and contribute to regulation of oxidative stress. These properties indicate potential applications in functional foods, nutraceuticals, and supportive health products. Similar to other *Tremella* species, *T. mesenterica* is considered a promising source of bioactive polysaccharides with immune-supporting and antioxidant potential (Hsu *et. al.* 2006; Lo *et. al.* 2012).

Ethnomycological records in the Nurata Range. No specific traditional medicinal application of *T. mesenterica* was documented among local communities of the Nurata Range during the present study. However, the species has a history of culinary and medicinal use in East Asian traditions, where gelatinous *Tremella* fungi have been consumed as functional foods and health-promoting ingredients. Traditionally, preparations from *Tremella* species have been associated with improving general vitality, supporting immunity, and maintaining health. Modern studies provide partial support for these traditional concepts through evidence of antioxidant and immunomodulatory activities. The presence of *T. mesenterica* in the Nurata Range contributes to the documentation of regional fungal diversity and expands knowledge of potentially valuable jelly fungi resources.

***Volvariella bombycina* (Schaeff.) Singer, Lilloa 22: 401 (1951) [MB#307781] (Table 2, Fig. 8D)**

Morphological description. *V. bombycina* is a saprotrophic agaricoid basidiomycete producing small to medium-sized annual fruiting bodies. The pileus is silky, smooth, and white to cream-colored, while the stipe is slender, fragile, and whitish. Lamellae are free from the stipe, initially pale and becoming pinkish to brownish as spores mature. Basidiospores are smooth, ellipsoid, and pinkish-brown, measuring approximately $8\text{--}12 \times 5\text{--}7 \mu\text{m}$. The species possesses a monomitic hyphal system composed of septate generative hyphae with clamp connections (Watling, 2001; Chang & Miles, 2004).

Distribution and habitat in the Nurata Range. *V. bombycina* is distributed throughout temperate regions of Asia, Europe, and North America. It is primarily associated with decaying hardwood substrates, where it develops as a saprotroph contributing to wood decomposition. In the Nurata Range, the species has been recorded rarely on decomposing trunks and branches of *Juglans* and *Populus* trees, indicating a limited but stable occurrence. Its presence reflects the diversity of wood-inhabiting agaricoid fungi associated with deciduous trees in the region (Chang & Miles, 2004; Bernicchia & Gorjón, 2020).

Bioactive compounds and medicinal potential. Scientific information regarding the medicinal properties of *V. bombycina* remains limited. However, edible species of the genus *Volvariella* contain nutritional compounds, including proteins, polysaccharides, and phenolic metabolites, which may contribute to antioxidant activity. These characteristics suggest potential value as a functional food resource, although further pharmacological studies are required (Chang & Miles, 2004).

Ethnomycological records in the Nurata Range. *V. bombycina* is mainly recognized as an edible mushroom in regions where it is traditionally collected. During surveys in the Nurata Range, no specific medicinal use was recorded, and local utilization appears to be limited. Its occurrence on hardwood substrates highlights its ecological importance as a decomposer, while its edible potential represents an underutilized fungal resource within the local ethnomycological context.

***Volvariella volvacea* (Bull.) Singer, Lilloa 22: 401 (1951) [MB#307802] (Table 2)**

Morphological description. *V. volvacea* is a saprotrophic agaricoid basidiomycete producing small to medium-sized annual fruiting bodies. The pileus is bell-shaped to convex, smooth, and light brown to grayish in color. Lamellae are free, initially white and becoming pinkish as spores mature. The stipe is hollow, fragile, and white, arising from a membranous volva at the base. Basidiospores are smooth, ellipsoid, and pinkish-brown, measuring approximately $8\text{--}12 \times 5\text{--}7 \mu\text{m}$ (Chang & Miles, 2004; Wasser, 2014).

Distribution and habitat in the Nurata Range. *V. volvacea* is widely distributed in tropical and subtropical regions and is one of the most important cultivated edible mushrooms in Asia. It naturally grows on agricultural residues, straw, compost, and decomposing plant materials. In the Nurata Range, the species occurs in open habitats such as grasslands, pastures, and areas with accumulated herbaceous organic matter. Its ability to utilize nutrient-rich plant residues enables it to survive in disturbed and semi-natural environments.

Bioactive compounds and medicinal potential. *V. volvacea* is valued for its nutritional and medicinal properties. The species contains polysaccharides, proteins, amino acids, and phenolic compounds associated with antioxidant, immunostimulatory, and protective biological activities. Polysaccharide extracts have demonstrated immune-enhancing effects, supporting its importance as a functional food and nutraceutical mushroom (Wasser, 2014; Chang & Miles, 2004).

Ethnomycological records in the Nurata Range. Although *V. volvacea* is widespread in the Nurata Range, local communities rarely collect or consume this species. Unlike some other edible mushrooms in the region, it has limited recognition in traditional food practices. Its low utilization may reflect insufficient local awareness rather than lack of nutritional value. The documentation of *V. volvacea* in the region highlights its potential as an underexploited edible mushroom resource and contributes to understanding the relationship between fungal biodiversity and local ethnomycological knowledge.



Figure 8. A - *Phallus impudicus*, B - *Trametes versicolor*, C - *Coprinus comatus*, D - *Volvariella bombycina*, E - *Tremella mesenterica*, F - *Flammulina velutipes*. Photo credit by Ilyor Mustafaev.

Discussion

Taxonomic Diversity and Ecological Adaptations of Medicinal Macrofungi

The documentation of 27 species of medicinal basidiomycetes belonging to 21 genera and 11 families reveals a notable mycological diversity within the semi-arid mountain ecosystems of the Nurata Range. The pronounced dominance of the families Polyporaceae and Agaricaceae, alongside significant representatives from Lycoperdaceae, Pleurotaceae, Hymenochaetaceae, Strophariaceae, and Pluteaceae, reflects both the environmental constraints and the microclimatic heterogeneity of this arid middle-altitude region. Wood-decaying polypores and corticioid fungi exhibit distinct host preferences and spatial segregation. Perennial wood-decaying species such as *Phellinus igniarius* and *Trametes versicolor*, alongside annual species like *Cerioporus squamosus*, *Fomes fomentarius*, and *Ganoderma resinaceum*, are strictly confined to mesophytic habitats, which aligns with wider ecological patterns observed in regional woody ecosystems (Ryvarden & Melo, 2014; Bernicchia & Gorjón, 2020). These species colonize weakened living trees, fallen logs, and stumps of *Juglans regia*, *Populus* spp., *Salix* spp., *Morus* spp., and *Lonicera* spp. along humid river valleys, riparian zones, and traditional mountain orchards. *Phellinus igniarius* and *Trametes versicolor*, in particular, play vital ecological roles as white-rot decomposers, and their persistent, tough, or woody basidiomata allow them to survive the extreme temperature fluctuations characteristic of the Central Asian mountain climate (Badalyan & Gharibyan, 2020; He *et al.* 2021).

Other wood-inhabiting species display more delicate or transient growth strategies. The gelatinous *Tremella mesenterica* and the silken *Volvariella bombycina* are rarely recorded, developing on decomposing broadleaf wood under highly specific, temporarily humid microclimates (Pippola & Kotiranta, 2008; Hsu *et al.* 2006). The saprotrophic *Phallus impudicus* is similarly restricted to moisture-rich, humus-accumulating microhabitats under dense *Juglans regia* canopy near mountain streams, where its transient, smelly fruiting bodies emerge during brief wet spells (Pegler *et al.* 1995; Kirk *et al.* 2008). Conversely, terrestrial and pasture-associated saprotrophs exploit the open, sun-exposed grassy landscapes of the ridge. Members of the Agaricaceae, such as *Agaricus bitorquis* and *Agaricus campestris*, alongside gasteroid Lycoperdaceae like *Bovista plumbea*, *Calvatia cyathiformis*, and *Calvatia gigantea*, are highly adapted to steppe-like pastures and meadows (Krakhmalnyi *et al.* 2023). These species rely on rapid spore germination and mycelial expansion strategies immediately following unstable winter and spring precipitations. This grassland ecology is shared by *Stropharia coronilla*, which thrive in moisture-retaining, organic-rich, and dung-enriched soils near riparian areas (Noordeloos, 2011). Furthermore, *Pleurotus eryngii* exhibits a highly specialized ecological strategy, acting as a saprotroph or weak parasite on the underground roots of Apiaceae host plants, specifically *Ferula* species, which dominate the high-altitude steppe zones between 1000 and 2500 meters (Wasser, 2014). This striking ecological division illustrates how the complex relief of the Nurata Range creates distinct niches that support diverse fungal survival strategies.

Table 2. Taxonomic, ecological, and ethnomycological characteristics of macrofungal species recorded in the Nuratau Range

Species	Folk name	Language	Family	Growth substrate / Habitat	Ecological guild	Use	Voucher specimens
<i>Agaricus bitorquis</i> (Qué.) Sacc.	Oq zamburug`	Uzbek	Agaricaceae	Humus-rich grasslands, pastures	Saprotrophic	Collected for food and local sale	TASM-AB-012
<i>Agaricus campestris</i> L.	Qo`zidumba	Uzbek/Tajik	Agaricaceae	Humus-rich grasslands, pastures	Saprotrophic	Collected for food and local sale	TASM-AC-013
<i>Bovista plumbea</i> Pers.	Eshakxina	Uzbek/Tajik	Agaricaceae	Grasslands, pastures, meadows	Saprotrophic	Medicinal: used for wound healing and treatment of burns	TASM-BP-059
<i>Calvatia cyathiformis</i> (Bosc.) Morgan	Eshakxina	Uzbek/Tajik	Agaricaceae	Grasslands, pastures, meadows	Saprotrophic	Medicinal: used for wound healing and treatment of burns	TASM-CCy-009
<i>Calvatia gigantea</i> (Batsch) Lloyd	Ilon telpak/ Telpaki mor	Uzbek/Tajik	Agaricaceae	Grasslands, pastures	Saprotrophic	Medicinal/veterinary: mature spore powder applied to wounds and burns; mixed with petroleum jelly or Solidol for animal wounds	TASM-CG-042
<i>Cerioporus squamosus</i> (Huds.) Qué.	Qo`tir zamburug`	Uzbek	Polyporaceae	Dead and weakened <i>Juglans</i> , <i>Populus</i> , <i>Salix</i>	Wood-decay pathogen	No traditional use recorded	TASM-CS-087
<i>Cerrena unicolor</i> (Bull.) Murrill	—	-	Polyporaceae	Dead hardwood logs	Saprotrophic (wood-decaying)	No traditional use recorded	TASM-CU-043
<i>Collybia personata</i> (Fr.) Z.M. He & Zhu L. Yang	Sariq zamburug`	Uzbek	Tricholomataceae	Meadows, pastures, forest edges	Saprotrophic	Collected for food and local sale	TASM-CP-097
<i>Coprinus comatus</i> (O.F. Müll.) Pers.	Go`ng zamburug`	Uzbek	Agaricaceae	Lawns, grasslands, disturbed soils	Saprotrophic	No traditional use recorded	TASM-CC-068
<i>Flammulina velutipes</i> (Curtis) Singer	—	-	Physalaciaceae	Dead hardwood logs and stumps	Saprotrophic	Food: edible; preparation not recorded.	TASM-FV-051
<i>Fomes fomentarius</i> (L.) Fr.	Po`kak	Uzbek/Tajik	Polyporaceae	Dead or weakened <i>Juglans</i> and other hardwoods	Wood-decay pathogen	Material/medicinal: used as tinder and in folk medicine	TASM-FF-079
<i>Ganoderma applanatum</i> (Pers.) Pat.	Po`kak	Uzbek/Tajik	Polyporaceae	Dead hardwood trunks	Saprotrophic (wood-decaying)	No traditional use recorded	TASM-GA-072
<i>Ganoderma resinaceum</i> Boud.	—	-	Polyporaceae	<i>Salix alba</i> , hardwood trees	Saprotrophic (wood-decaying)	Limited medicinal use	TASM-GR-008
<i>Inonotus hispidus</i> (Bull.) P. Karst.	Po`kak	Uzbek/Tajik	Hymenochaetaceae	<i>Juglans</i> , <i>Morus</i> and other hardwoods	Wood-decay pathogen	Material: used as a natural dye ("Pukak")	TASM-IH-019
<i>Laetiporus sulphureus</i> (Bull.) Murrill	Sariq zamburug`	Uzbek	Laetiporaceae	<i>Salix</i> , <i>Populus</i> , <i>Juglans</i> , <i>Prunus</i>	Wood-decay pathogen	Food: young basidiomata consumed	TASM-LS-062

<i>Lentinus brumalis</i> (Pers.) Zmitr.	–	-	Polyporaceae	Decaying hardwood, <i>Artemisia</i> spp. stems	Saprotrophic (wood-decaying)	No traditional use recorded	TASM-LT-081
<i>Lentinus tigrinus</i> (Bull.) Fr.	Oq qo`tir zamburug`	Uzbek	Polyporaceae	Dead <i>Populus</i> , <i>Salix</i> and hardwood logs	Wood-decay pathogen	Collected for food and local sale	TASM-LT-014
<i>Phallus impudicus</i> L.	-	-	Phallaceae	Humus-rich soil in walnut forests near streams	Saprotrophic	No traditional use recorded	TASM-Phi-012
<i>Phellinus igniarius</i> (L.) Quél.	Qora qo`tir	Uzbek	Hymenochaetaceae	<i>Juglans</i> , <i>Morus</i> and other trees	Wood-decay pathogen	No traditional use recorded	TASM-Phlg-023
<i>Pleurotus eryngii</i> (DC.) Quél.	Chanbush	Uzbek/Tajik	Pleurotaceae	Associated with <i>Ferula</i> roots in mountain areas	Saprotrophic	Food: fried fresh; dried for later consumption; incorporated into Bichak; consumed seasonally	TASM-PE-033
<i>Pleurotus ostreatus</i> (Jacq.) P. Kumm.	Zamburug`	Uzbek/Tajik	Pleurotaceae	<i>Salix</i> , <i>Populus</i> , <i>Morus</i>	Saprotrophic (wood-decaying)	Food: collected and consumed locally	TASM-PO-041
<i>Schizophyllum commune</i> Fr.	-	-	Schizophyllaceae	Dry, fallen or decaying hardwood logs, stumps, and dead branches	Saprotrophic (wood-decaying)	No traditional use	TASM-SC-021
<i>Stropharia coronilla</i> (Bull.) Quél.	Sariq zamburug`	Uzbek	Strophariaceae	Meadows, pastures, humus-rich soils, especially near streams	Saprotrophic	Food: collected and consumed locally	TASM-SC-008
<i>Trametes versicolor</i> (L.) Lloyd	-		Polyporaceae	Dead hardwood logs	Saprotrophic (wood-decaying)	-	TASM-TV-036
<i>Tremella mesenterica</i> Retz.	-		Tremellaceae	<i>Crataegus</i> , dead hardwood branches	Saprotrophic (wood-decaying)	-	TASM-TM-005
<i>Volvariella bombycina</i> (Schaeff.) Singer	Safet qo`ziqorin	Tajik	Pluteaceae	<i>Juglans</i> and <i>Populus</i>	Saprotrophic	Food: collected and occasionally consumed	TASM-VB-011
<i>Volvariella volvacea</i> (Bull.) Singer	-		Pluteaceae	Grasslands and herbaceous vegetation	Saprotrophic	Rarely utilized locally	TASM-VV-003

Ethnomycological knowledge and topical human therapies

The results of this study demonstrate that local communities in the Nurata Ridge possess a rich, historically rooted body of ethnomycological knowledge. This traditional heritage is highly functional, serving as an important component of primary healthcare in remote mountain villages where modern medical access is physically or economically restricted, a phenomenon widely documented in other rural mountainous territories (Harsh *et. al.* 1993; Boa, 2004). A particularly prominent practice documented among the informants is the topical application of gasteroid fungi to treat skin injuries. Locally referred to under collective vernacular names such as "Ilon telpak" or "Eshakhina" in Uzbek and "Telpaki mor" in Tajik, puffballs like *Bovista plumbea*, *Calvatia cyathiformis*, and *Calvatia gigantea* are harvested at maturity, dried, and carefully stored for future use. When applied to cuts, burns, and purulent wounds, the dry, powdery mature spore mass acts as a natural physical barrier, absorbing exudates and stopping minor hemorrhages. This traditional application is strongly supported by modern pharmacological studies, which have demonstrated the antimicrobial, anti-inflammatory, and hemostatic properties of these gasteroid spores, validating centuries of empirical local observations (Wasser, 2010; Alves *et. al.* 2012; Owaid *et. al.* 2019). Interestingly, while species with conspicuous morphology or pleasant utility are highly integrated into local folklore, highly specialized wood-decaying medicinal fungi with proven pharmacological properties, such as *Phellinus igniarius* and *Trametes versicolor*, lack specific local therapeutic recognition despite their abundance. This gap highlights a clear divergence between globally established biomedical applications (Dou *et. al.* 2019; He *et. al.* 2021) and localized, orally transmitted folk medicine.

Ethnoveterinary practices and regional cultural transmission

An outstanding finding of this research is the documentation of specialized ethnoveterinary practices in the Forish district, which highlights the deep integration of fungi into local agricultural survival strategies. Local mountain residents utilize the mature spore powder of *Calvatia gigantea* mixed with petroleum jelly or industrial grease, such as Solidol, to formulate a thick, topical healing paste. This paste is applied directly to deep, chronic, or infected wounds in working animals, specifically horses and donkeys, to accelerate tissue regeneration and prevent secondary infections. For weeping or purulent animal wounds, the dry spore powder is applied directly in its pure form to absorb fluids and dry the affected tissue. The occurrence of identical practices in the neighboring Kattakurgan District of the Samarkand Region suggests a shared, culturally cohesive ethnomycological heritage across central Uzbekistan (Mustafaev *et. al.*, 2025). This indicates that traditional knowledge of fungal therapeutic properties has not evolved in isolation but has been actively transmitted and preserved across culturally and geographically connected communities, serving as a reliable alternative to veterinary pharmaceuticals, consistent with broader ethnobotanical and ethnoveterinary trends in Central Asia.

Nutritional utilization and the "Ethnomycological filter"

A comparative analysis of local practices reveals a highly selective "ethnomycological filter" regarding food and medicinal choices in the region (Pérez-Moreno *et. al.* 2021). *Pleurotus eryngii*, locally known as "Chanbush" or "White desert mushroom," and *Pleurotus ostreatus*, the oyster mushroom, are among the most highly valued and actively collected wild edible species. *Pleurotus eryngii* is prepared as a fried seasonal food, dried for year-round consumption, or utilized in traditional culinary dishes like "Bichak" (samsa) by shepherd communities. Local inhabitants also attribute specific health-promoting properties to *P. eryngii*, particularly in managing diabetes, which aligns with modern clinical research demonstrating its hypoglycemic and immunomodulatory activities (Wasser, 2014). Similarly, *Agaricus bitorquis*, *Agaricus campestris*, *Collybia personata*, and *Stropharia coronilla* are actively sought after in grasslands, with the former three species also being commercialized in roadside markets to provide crucial seasonal household income. In contrast, several species with high nutritional and culinary value globally are completely ignored by local collectors. For instance, *Cerioporus squamosus*, *Volvariella bombycina*, and *Volvariella volvacea* are abundant in their respective habitats, yet they are completely underutilized. Furthermore, the striking and smelly *Phallus impudicus* is avoided entirely due to its offensive odor and unusual phallic shape, which deters any local acceptance (Hobbs, 2002). This selective consumption is not due to a lack of resource availability but rather to a cultural preference for familiar, ground-dwelling agarics and well-known tree-dwelling oyster mushrooms, suggesting that targeted educational outreach regarding underutilized edible species could significantly enhance local food security and diversify seasonal income sources.

Comparison with ethnomycological records from Central Asia

The ethnomycological practices documented in the Nurata Range show both shared regional patterns and locally specific differences when compared with fungal knowledge reported from other parts of Central Asia. Across the region, wild fungi are recognized as locally available biological resources, but their importance and uses vary according to ecological conditions, subsistence practices, and culturally transmitted knowledge. In Tajikistan, for example, ethnobotanical research among Yaghnobi and Tajik communities in the Varzob Valley documented *Pleurotus* sp. as a wild food resource, traditionally

prepared by boiling followed by frying in oil (Söukand *et. al.* 2021). Similarly, comparative evidence from Kazakh and Kyrgyz communities in Tekes, Xinjiang, indicates that wild mushrooms form part of traditional food knowledge, with eight mushroom taxa documented among traditional non-animal-based food resources (Wang *et. al.* 2026). These records are broadly consistent with the use of wild edible fungi documented in the Nurata Range, where *Pleurotus eryngii*, *P. ostreatus*, *Agaricus campestris*, *A. bitorquis*, and *Stropharia coronilla* are collected and consumed.

At the same time, the comparison reveals important differences in the cultural roles assigned to particular fungal taxa. In the Nurata Range, several gasteroid fungi, particularly *Calvatia gigantea*, *Calvatia cyathiformis*, and *Bovista plumbea*, are traditionally associated with the treatment of wounds and burns through topical application of their mature spore mass. In contrast, ethnobiological research among Kyrgyz nomadic communities documented *Agaricus* sp. under the local name “At Tepik” as a fungus used in veterinary practice, with its spores reportedly applied to infected animal wounds, while the fungus itself was not consumed and was considered “unclean” (Soelberg & Jäger, 2016). This contrast illustrates that the same broad category of fungal resources may be incorporated into different cultural domains—food, human medicine, veterinary practice, or avoidance—depending on local knowledge systems. Thus, the absence of a food use does not necessarily indicate that a fungus is culturally unimportant; in some cases, avoidance or non-food applications may represent equally meaningful forms of ethnomycological knowledge.

The Nurata records also differ from neighboring Central Asian reports in the relative prominence of fungal species associated with local ethnoveterinary and topical medicinal practices. The use of *Calvatia* and *Bovista* spores for wounds and burns, together with the documented application of *Calvatia gigantea* to wounds of domestic animals, represents a locally distinctive component of the ethnomycological repertoire recorded in the present study. Such practices should nevertheless be interpreted as traditional knowledge rather than evidence of clinical efficacy, unless supported by pharmacological or clinical studies.

Ecological and economic factors provide an additional explanation for regional differences in fungal use. Studies from the forest-steppe regions of Kazakhstan have shown that the biological and economic productivity of wild edible mushrooms varies with geographical position, forest composition, climatic conditions, ecological zones, and altitude. Thirteen dominant edible mushroom species were reported, with yields reaching approximately 40–90 kg/ha in some years (Aidarkhanova *et. al.* 2019). These findings indicate that the availability and potential economic value of wild mushrooms are strongly influenced by habitat conditions and seasonal productivity, in addition to cultural preferences. A similar relationship is evident in the Nurata Range, where edible species are concentrated in grasslands, riparian habitats, forest margins, walnut-fruit forests, and other locally favorable microhabitats. Consequently, differences in the species recognized and collected by local communities may partly reflect differences in fungal availability, host vegetation, moisture regimes, and seasonal fruiting patterns rather than cultural preferences alone.

Economic use also appears to vary among regions. In the Nurata Range, several edible species, including *Agaricus campestris*, *A. bitorquis*, *Pleurotus* spp., and *Stropharia coronilla*, are collected for household consumption and, in some cases, local sale. The available Central Asian literature likewise indicates that wild edible mushrooms may have both subsistence and economic value, although the intensity and scale of commercialization differ between regions. The Kazakhstan data on seasonal fungal productivity further demonstrate that wild mushrooms can represent a variable biological resource whose economic importance depends on annual environmental conditions (Aidarkhanova *et. al.* 2019). These observations suggest that local fungal use should be understood within a broader ecological-economic context rather than solely as a reflection of cultural preference.

An additional point of convergence concerns the importance of negative knowledge. The Kyrgyz example, in which *Agaricus* sp. was reportedly avoided as food despite its veterinary use (Soelberg & Jäger, 2016), demonstrates that culturally transmitted knowledge includes not only species that are actively consumed or medicinally utilized but also those that are rejected, considered unsuitable, or associated with particular restrictions. In the Nurata Range, the avoidance of *Phallus impudicus*, as well as the absence of recorded food uses for several other species, similarly indicates that local fungal classification involves both positive and negative knowledge. Such distinctions may reflect perceived toxicity, unpleasant sensory characteristics, unfamiliar morphology, cultural norms, or simply the absence of an established tradition of use.

Overall, comparison with available ethnomycological records from Central Asia indicates a combination of shared and divergent patterns. Shared elements include the seasonal collection of wild edible fungi and the incorporation of selected species into local food systems. Divergences are evident in the particular taxa recognized, preparation methods, medicinal

and veterinary applications, commercial use, and culturally transmitted avoidance of certain fungi. These differences appear to arise from an interaction among ecological availability, host vegetation, climate and seasonality, local subsistence strategies, economic opportunities, and historically transmitted cultural knowledge. The Nuratau Range therefore represents not an isolated ethnomycological system, but a locally distinctive component of a broader Central Asian tradition of fungal knowledge and resource use.

Knowledge erosion and urgent conservation imperatives

Our demographic analysis of the sixty interviewed informants reveals that ethnomycological expertise is heavily skewed toward older generations aged between 40 and 70 years. Younger residents show a rapidly declining interest in traditional remedies due to rapid socio-economic modernization, increased availability of commercial pharmaceuticals, and migration to urban centers. Consequently, there is an urgent and irreversible risk of losing this rich oral cultural heritage, a global threat highlighted by several ethnobiological authorities (Pieroni & Vandeboek, 2007; Pérez-Moreno *et al.* 2021). Systematic documentation, such as the baseline data compiled in the present study, is vital to preserve these ancient practices before they disappear entirely from collective memory. Furthermore, the survival of these medicinal and edible macrofungi is tightly linked to the preservation of their delicate habitats. Host trees such as *Juglans regia*, *Populus* spp., *Salix* spp., and herbaceous hosts like *Ferula* species are increasingly threatened by anthropogenic pressures, including overgrazing, illegal wood cutting, and climate-induced aridization. The Nurata Nature Reserve plays a critical role in this regard by strictly protecting relic walnut-fruit forests, grassland steppes, and humid riparian valleys (Beshko *et al.* 2025), serving as a crucial *in situ* genetic sanctuary for both target host plants and their associated medicinal macrofungi.

Sustainable management of wild fungal resources and local livelihoods

The documented diversity and patterns of local use also have important implications for the sustainable management of wild fungal resources in the Nurata Range. Although the present study did not quantitatively assess harvesting intensity or population trends, the regular collection and local sale of several edible species indicate that some fungal resources contribute directly to household food supplies and seasonal incomes. Sustaining these benefits requires harvesting practices that avoid excessive removal of fruiting bodies and allow sufficient regeneration, particularly for species collected repeatedly from accessible grasslands, riparian habitats, and forest margins.

The sustainability of these resources is closely linked to the condition of their host habitats. Many of the documented fungi depend on mature or weakened trees, fallen wood, dead branches, and relatively humid microhabitats associated with *Juglans*, *Populus*, *Salix*, and other woody species. Therefore, overgrazing, wood cutting, removal of deadwood, habitat degradation, and increasing aridity may reduce fungal habitats even where the fungi themselves are not directly harvested. Maintaining host trees, deadwood, riparian vegetation, and habitat heterogeneity should consequently be considered an integral component of fungal resource management.

Wild edible fungi also contribute to local food security by providing seasonally available foods and, for some households, opportunities for supplementary income through collection and local trade. The commercialization of species such as *Agaricus campestris*, *A. bitorquis*, *Pleurotus eryngii*, *Pleurotus* and *Stropharia coronilla* suggests that fungal gathering can form part of small-scale rural livelihoods. Strengthening these benefits requires a balance between local access and resource conservation, supported by species-level identification, sustainable harvesting guidelines, community monitoring, and awareness of habitat protection. Future studies should therefore quantify harvesting pressure, population abundance, regeneration rates, and the economic contribution of wild mushrooms to household livelihoods to establish a stronger basis for long-term resource management.

Community-centered applications and biocultural heritage

The ethnomycological knowledge documented in the Nurata Range has important potential for community-centered food, livelihood, conservation, and biocultural heritage initiatives. Rather than remaining solely as a record of traditional practices, this knowledge could support sustainable use of locally available fungal resources. Edible species such as *Agaricus campestris*, *A. bitorquis*, *Pleurotus eryngii*, *P. ostreatus*, and *Stropharia coronilla* could be incorporated into local food networks through sustainable harvesting and community-based marketing, potentially strengthening seasonal household incomes while maintaining traditional culinary practices.

Small-scale value addition could further increase the practical benefits of these resources. Locally collected edible mushrooms could be dried, powdered, or processed into other food products to extend their seasonal availability and create additional livelihood opportunities. Such activities, however, should be supported by reliable species identification, food-safety

standards, sustainable harvesting guidelines, and appropriate quality control. Medicinally important species should likewise be treated cautiously, as their documented pharmacological potential does not by itself justify therapeutic commercialization without further experimental and clinical validation.

The documented knowledge also provides a valuable foundation for community-based biocultural heritage programs. Traditional fungal names, habitats, collection practices, food preparation methods, and ethnoveterinary uses could be recorded and transmitted through collaboration between local knowledge holders, younger generations, researchers, and community organizations. Intergenerational education and participatory documentation could help prevent knowledge loss while increasing awareness of fungal diversity and the habitats on which these resources depend. Importantly, conservation should encompass not only fungal species but also host trees, riparian habitats, traditional landscapes, and cultural practices that sustain their continued use.

Thus, integrating ethnomycological knowledge with sustainable harvesting, local food systems, small-scale value addition, and biocultural heritage conservation could translate the findings of this study into practical community benefits while supporting the long-term conservation of fungal diversity and traditional ecological knowledge.

Study Limitations and Future Perspectives

The primary focus of this study was ethnomycological documentation and field-based morphological identification. While standard macro- and micromorphological taxonomic keys were rigorously applied, and species names were verified against international nomenclatural databases (Index Fungorum, MycoBank), future studies incorporating molecular sequencing (e.g., ITS rDNA) will further complement the species-level taxonomy of complex lineages in the region.

Declarations

Ethics approval and consent to participate: All participants involved in the interview process gave their prior informed oral consent.

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