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Traditional Knowledge of Mushroom Utilization by the Dayak Kubin Tribe: A Case Study in Nanga Raku Village, West Kalimantan

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Abstract. The Dayak Kubin Tribe, which inhabits Nanga Raku Village, Sayan District, Melawi Regency, West Kalimantan Province, still utilizes mushrooms daily. However, this knowledge has not been documented until now. This research aims to provide information on the diversity of mushroom species and their utilization by the Dayak Kubin Tribe in Nanga Raku Village. This qualitative research was conducted in Nanga Raku Village in May 2022. The informants in this research amounted to 15 people obtained through the snowball sampling technique. The search for mushroom samples was carried out using the cruising method. The results showed that the Dayak Kubin Tribe in Nanga Raku Village utilizes 16 species of mushrooms. Mushroom species used as food sources are *Agaricus* sp., *Auricularia auricula-judae*, *Auricularia delicata*, *Termitomyces* sp., *Lactocollybia* sp., *Marasmiellus candidus*, *Pleurotus cystidiosus*, *Lentinus sajor-caju*, *Panus* sp., *Psathyrella* sp., *Cookeina sulcipes*, *Cookeina tricholoma*, and *Schizophyllum commune*. Mushroom species utilized as medicines are *Microporus affinis* and *Microporus xanthopus*. *Hygrocybe* sp. is the only mushroom species that is used as a food source and medicinal ingredient at the same time. The ethnomycological information presented in this research is an effort to preserve traditional knowledge by utilizing biodiversity in the surrounding environment.

Keywords: Dayak Kubin Tribe; ethnomycology; Fungi; mushroom; Nanga Raku Village

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INTRODUCTION

West Kalimantan is one of Indonesia's provinces with vast forest areas (Yagoza & Maksum, 2024). Large forest areas in West Kalimantan encourage a high level of biodiversity. One form of biodiversity that can be found in the forests of West Kalimantan is mushrooms. Mushroom is a term used to refer to members of the Fungi kingdom that are macroscopic and have fruiting bodies that can be seen without having to use a microscope (Alfatinnisa et al., 2023). Besides playing an essential role in the balance of the ecosystem, many species of mushrooms can be consumed by humans.

In the era of global sustainability, intensification of mushroom utilization can be done to overcome the shortage of vegan protein sources in the current market (Sangeeta et al., 2024). This causes the diversity of mushrooms that can be consumed to be exciting to study. Mushrooms contain many health benefits due to their diverse nutritional composition (Sharma et al., 2024). Knowledge of mushroom utilization for consumption has been found in various countries for centuries, including Indonesia. Knowledge of traditional mushroom utilization must be documented to avoid losing this knowledge. Studies examining mushroom utilization by traditional communities are referred to as ethnomycology.

Ethnomycology is a branch of science that examines the relationship between traditional societies and the use of mushrooms as part of daily life, whether for consumption, medicinal, or ritual purposes (Ullah et al., 2022). Ethnomycological studies are important because they provide a way to improve understanding of the use of mushrooms by different ethnicities and provide a clearer picture of their classification, utilization, and

ecology (López-García et al., 2024). Ethnomycological studies contribute to documenting local knowledge that is often only passed down orally from one generation to the next. This is by the statement of Motiejūnaitė et al. (2024) that the knowledge of traditional mushroom utilization is passed down from generation to generation to have a very high cultural value. Ethnomycological research in Indonesia has been conducted, such as Khastini et al. (2018) focusing on the Baduy Tribe in Kanekes Village, Banten; Yusran et al. (2021) with a focus on communities around the Lore Lindu National Park, Central Sulawesi; Yusran et al. (2022) with a community focus in Toro Village, Central Sulawesi; and Yusran et al. (2024) with a focus on the Pamona Tribe around Lake Poso, Central Sulawesi.

The Dayak Kubin Tribe in Nanga Raku Village, Sayan District, Melawi Regency, West Kalimantan Province, is one of the tribes in Indonesia that has in-depth knowledge of mushroom utilization. The Dayak Kubin Tribe is among many Dayak sub-tribes (Susanto & Budiman, 2021). The Dayak Tribe itself is the largest tribe that inhabits West Kalimantan (Sada et al., 2019). The distribution of the Dayak Kubin Tribe in Melawi Regency leads to the south, namely in the South Pinoh District. The Dayak Kubin Tribe can be found in Sungai Bakah Village, Nyanggai Village, Nanga Raya Village, and the surrounding areas. Based on interviews conducted with the Dayak Kubin Tribe in Nanga Raku Village, it is known that they commonly utilize various species of mushrooms for food and medicinal purposes.

So far, there has been no reporting of information on the traditional use of mushrooms by the Dayak Kubin Tribe in Nanga Raku Village, so conducting an ethnomycological research is necessary. Documentation of information derived from ethnomycological studies is vital to validate the identification of mushroom specimens and the preservation of natural resources that have cultivation potential to increase their utilization as a source of food and medicinal ingredients (Sitotaw et al., 2020). In addition, traditional knowledge of mushroom utilization has the potential to be lost due to the absence of records reporting local knowledge of the community (Sharma et al., 2022), the destruction of the natural habitat of these mushrooms (Mandal et al., 2023), and sociocultural changes (Haro-Luna et al., 2019).

The primary aim of the research is to explore and document the ethnomycological practices of the Dayak Kubin Tribe in Nanga Raku Village, Sayan District, Melawi Regency. This research seeks to understand how the tribe utilizes various mushroom species for both nutritional and medicinal purposes. By identifying and cataloguing mushroom species used by the tribe, the research aims to highlight the cultural and health-related significance of these fungi. The research provides significant benefits to both science and society by preserving the traditional knowledge of mushroom utilization by the Dayak Kubin Tribe, which is at risk of being lost due to environmental degradation and sociocultural changes. For science, it offers valuable insights into the nutritional and medicinal properties of various mushroom species, which can be further explored for potential health benefits. For society, particularly the local community, documenting this knowledge helps maintain cultural identity and supports biodiversity conservation efforts.

METHODS

This research was conducted in May 2022 in Nanga Raku Village, Sayan District, Melawi Regency, West Kalimantan Province, Indonesia. Nanga Raku Village borders Meta Bersatu Village, Mekar Pelita Village, Pekawai Village, Tumbak Raya Village, Landau Sadak Village, and Nanga Kompi Village (Figure 1). Based on data from *Badan Pusat Statistik Kabupaten Melawi (2024)*, Nanga Raku Village has an area of 103.7 km^2 and a population of 1,044 people. Nanga Raku Village consists of two hamlets: Kepayang Mekar Hamlet and Jongkong Hamlet.

This research is classified as qualitative research. Qualitative research aims to conduct a detailed descriptive and interpretative analysis of people's experiences, views, perspectives, and perceptions of their social reality (Barroga et al., 2023). This research focused on identifying and describing mushroom species that the Dayak Kubin Tribe traditionally utilizes. Data collection began by conducting interviews with 15 informants who are Dayak Kubin tribesmen who live in Nanga Raku Village. Informants were selected using the snowball sampling technique. Snowball sampling is a technique in which the researcher is linked from one informant to another so that the initially small number of samples will get bigger over time (Kirchherr & Charles, 2018). The interviews conducted were semi-structured, with the questions presented in Table 1.

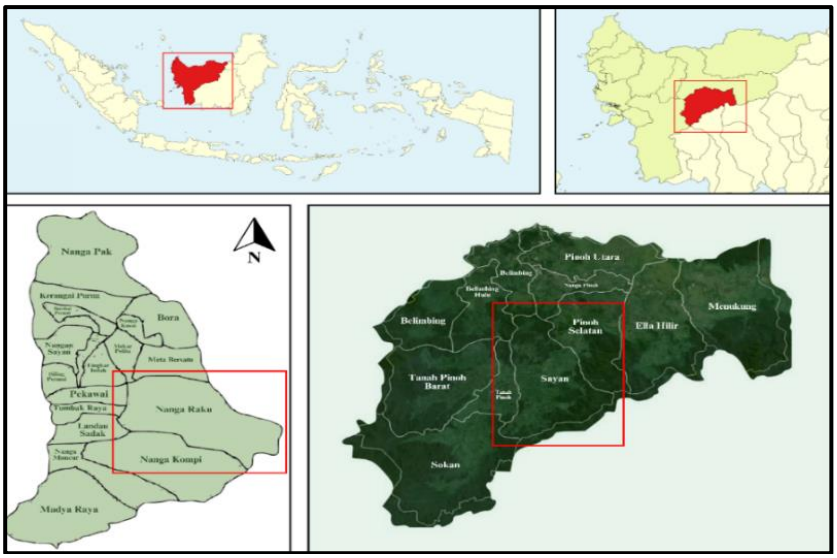

Figure 1. Map of the research location in Nanga Raku Village, Sayan District, Melawi Regency, West Kalimantan Province, Indonesia (Modified from MapChart (mapchart.net) and Badan Pusat Statistik Kabupaten Melawi, 2024)

Table 1. Questions listed in the interview guide

No.	Questions
1	Do you have any knowledge regarding commonly utilized mushrooms?
2	From whom did you obtain the knowledge?
3	What mushrooms do you utilize?
4	Do you have the skills to process the mushrooms?
5	How do you utilize the mushrooms?
6	Where can we find the mushrooms you utilize?

Data collection continued with the search for samples of each mushroom obtained from the interview. The search for mushroom samples was carried out using the cruising method. This research uses participant observation because researchers are directly involved in field observation activities. In addition, the observations were also accompanied by informants whom researchers interviewed because they were more knowledgeable about the mushroom species in question. Each mushroom sample obtained was then observed and documented. The identification of each mushroom sample was carried out using "*Collecting and Describing Macrofungi*" by Lodge et al. (2004), "*How to Identify Mushrooms to Genus I: Macroscopic Features*" by Largent & Stuntz (1986), "*How to Identify Mushrooms to Genus III: Microscopic Features*" by Largent et al. (1977), "*Mushrooms Demystified*" by Arora (1986), and "*Mushrooms: How to Identify and Gather Wild Mushrooms and Other Fungi*" by Læssøe (2013). Various scientific articles regarding information about the mushrooms are also used in this research.

The collected data is then analyzed. The qualitative data analysis refers to Miles et al. (2014), which consists of three stages: data condensation, data presentation, and conclusion drawing and verification. Data condensation involves selecting and simplifying data from interviews, field notes, and literature. The results of the data condensation stage are presented in the form of tables, figures, and graphs. Finally, conclusions are drawn based on the data from the previous two stages.

RESULTS AND DISCUSSION

Based on the results of data collection and analysis that has been carried out, 16 mushroom species were obtained that are utilized by the Dayak Kubin Tribe in Nanga Raku Village, which come from 11 families (Table 2). Most mushroom species utilized by the Dayak Kubin Tribe belong to the Polyporaceae family, totalling four species (25%), followed by the Auriculariaceae and Sarcoscyphaceae families, totalling two species each (12.50%) and the rest of the other families only totalling one species (6.25%) (Figure 2).

Table 2. List of mushroom species utilized by Dayak Kubin Tribe in Nanga Raku Village, Sayan District, Melawi Regency

Family	Species	Local Name	Utilization
Agaricaceae	*Agaricus* sp.	*Kulat tepo*	Food
Auriculariaceae	*Auricularia auricula-judae*	*Kulat korup*	Food
	Auricularia delicata	*Kulat ceber*	Food
Hygrophoraceae	*Hygrocybe* sp.	*Kulat susu*	Food, gastritis medicine
Lyophyllaceae	*Termitomyces* sp.	*Kulat tanah tumuh*	Food
Marasmiaceae	*Lactocollybia* sp.	*Kulat putih*	Food
Omphalotaceae	*Marasmiellus candidus*	*Kulat bubur*	Food
Pleurotaceae	*Pleurotus cystidiosus*	*Kulat koras*	Food
Polyporaceae	*Lentinus sajor-caju*	*Kulat sarang penyemongat*	Food
	Microporus affinis	*Kulat badunk*	Mosquito repellent
	Microporus xanthopus	*Kulat badunk*	Mosquito repellent, abdominal pain medicine
	Panus sp.	*Kulat mensait*	Food
Psathyrellaceae	*Psathyrella* sp.	*Kulat nior*	Food
Sarcoscyphaceae	*Cookeina sulcipes*	*Kulat mangkok*	Food
	Cookeina tricholoma	*Kulat mangkok*	Food
Schizophyllaceae	*Schizophyllum commune*	*Kulat taun*	Food

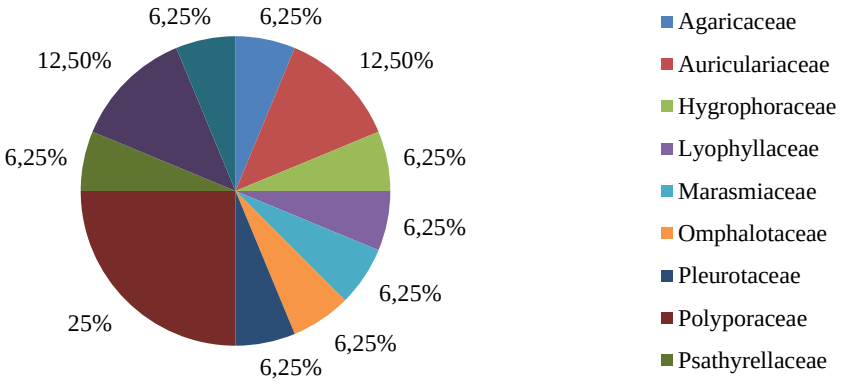

Figure 2. Percentage of mushroom families utilized by Dayak Kubin Tribe in Nanga Raku Village, Sayan District, Melawi Regency

The results showed that the mushrooms used by the Dayak Kubin Tribe in Nanga Raku Village mostly came from the Polyporaceae family. Polyporaceae is a family of fungi with the most species in Tropical Asia and one of the fungal families with good adaptability, so it can be found in various habitats (Zhao et al., 2024). In addition, Polyporaceae is one of the families with fruiting bodies that can survive for a long time. This can be caused by a saprophytic lifestyle (Runnel et al., 2021) and a rigid fruiting body that does not rot quickly (Joshi et al., 2021). The abundance of members of the Polyporaceae family in Nanga Raku Village encourages the Dayak Kubin Tribe, which inhabits the village, to have more knowledge of utilizing mushrooms from this family.

The Dayak Kubin Tribe knows *Agaricus* sp. as *kulat tepo*. They utilize this mushroom as a food source by stir-frying or frying. *Agaricus bisporus* contains high levels of proteins, amino acids, polyphenols, polysaccharides, ergothioneines, and vitamins (Ekowati et al., 2018). *Agaricus arvensis*, *Agaricus campestris*, *Agaricus comtulus*, and *Agaricus silvicola* has high protein, fiber, and low-fat content (Sharma & Gautam, 2015).

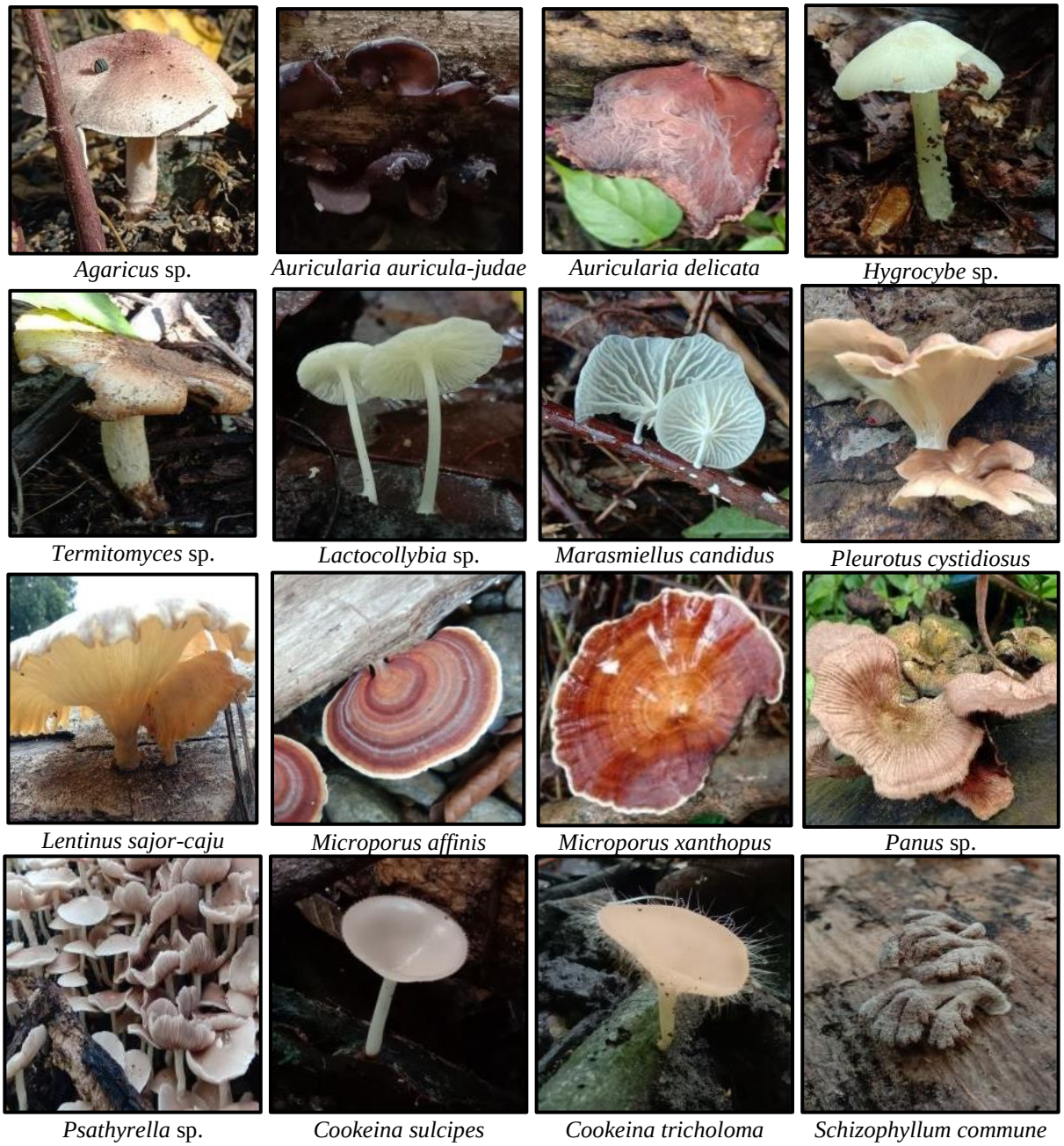

Figure 3. Documentation of mushroom species utilized by Dayak Kubin Tribe in Nanga Raku Village, Sayan District, Melawi Regency

The Dayak Kubin Tribe knows *Auricularia auricula-judae* as *kulat korup*. The Dayak Kubin Tribe utilizes this mushroom species for consumption. This mushroom is utilized as a mixture of soup or vegetables. *Auricularia auricula-judae* is known to have high total protein and carbohydrate content and very low fat, while also being a source of essential amino acids and ascorbic acids that benefit humans (Islam et al., 2021).

The Dayak Kubin Tribe knows *Auricularia delicata* as *kulat ceber*. The Dayak Kubin Tribe utilizes this mushroom species as a food ingredient. Just like *Auricularia auricula-judae*, this mushroom species is utilized by the Dayak Kubin Tribe as a mixture of soup or vegetables. *Auricularia delicata* contains high protein, carbohydrates, vitamins, minerals, and low cholesterol levels to be utilized as a healthy food source (Li et al., 2023).

The Dayak Kubin Tribe knows *Hygrocybe* sp. as *kulat susu*. This mushroom is a valuable food ingredient for the Dayak Kubin Tribe. The Dayak Kubin Tribe processes this mushroom by stir-frying. *Hygrocybe coccinea* and *Hygrocybe nivea* have good nutritional content because they

contain proteins, fibers, carbohydrates, fat and various secondary metabolites (Sharma & Gautam, 2015). In addition, the Dayak Kubin Tribe also uses this mushroom as a gastritis medicine. *Hygrocybe coccinea* and *Hygrocybe nivea* contain phenols and flavonoids (Sharma & Gautam, 2015), where the two secondary metabolites play a role in improving the healing process of gastritis (Chen et al., 2023).

The Dayak Kubin Tribe knows *Termitomyces* sp. as *kulat tanah tumuh*. The Dayak Kubin Tribe utilizes this mushroom as a food source. They process this mushroom by stir-frying. All species of *Termitomyces* can be consumed and have unique values related to texture, taste, and nutritional content (Paloi et al., 2023).

The Dayak Kubin Tribe knows *Lactocollybia* sp. as *kulat putih*. The Dayak Kubin Tribe utilizes this mushroom as a food ingredient by stir-frying. We cannot find information related to the nutritional content of *Lactocollybia*. However, information related to the utilization of several species of the genus *Lactocollybia* for consumption has been reported, such as *Lactocollybia angiospermarum* (Yian & Tiebre, 2018) and *Lactocollybia epia* (Amelia et al., 2024).

The Dayak Kubin Tribe knows *Marasmiellus candidus* as *kulat bubur*. The Dayak Kubin Tribe utilizes this mushroom for consumption. The way they utilize this mushroom species is by stir-frying. *Marasmiellus candidus* is rich in protein, fiber, carbohydrates, and minerals and has low fat and iron content, indicating that this mushroom is very nutritious (Titilawo et al., 2020).

The Dayak Kubin Tribe knows *Pleurotus cystidiosus* as *kulat koras*. This mushroom species is utilized as a food source by the Dayak Kubin Tribe. *Pleurotus cystidiosus* has an edible stalk and hood with a very high nutrient content (including protein, fiber, vitamins, and minerals) (Dawidowicz et al., 2018).

The Dayak Kubin Tribe knows *Lentinus sajor-caju* as *kulat sarang penyemongat*. The Dayak Kubin Tribe utilizes this mushroom species as a food source. *Lentinus sajor-caju* contains high protein and carbohydrates, as well as micronutrients and minerals in reasonable amounts while also having a low-fat content, making it ideal for use as an alternative food source (Singdevsachan et al., 2013).

The Dayak Kubin Tribe knows *Microporus affinis* as *kulat badunk*. The Dayak Kubin Tribe utilizes this mushroom species as an insect repellent. *Microporus affinis* contains several secondary metabolites, including ketones, sterols, and esters (Aneesh & Thoppil, 2020). Secondary metabolites are thought to repel insects or cause direct toxic symptoms that trigger growth inhibition, resulting in insect death (Divekar et al., 2022).

The Dayak Kubin Tribe knows *Microporus xanthopus* as *kulat badunk*. Like *Microporus affinis*, the Dayak Kubin Tribe utilizes this mushroom species as an insect repellent. Phytochemical screening shows that *Microporus xanthopus* contains secondary metabolites in flavonoids, steroids, saponins, tannins, and coumarins (Herawati et al., 2021), which are assumed to be able to act as an anti-insect agent. In addition, the Dayak Kubin Tribe also utilizes this mushroom species as a remedy for abdominal pain. Treatment of abdominal pain is generally related to pharmacological mechanisms, such as anti-inflammatory, antioxidant, and antibacterial (Ghaneialvar et al., 2020), triggered by the presence of secondary metabolites.

The Dayak Kubin Tribe knows *Panus* sp. as *kulat mensait*. The Dayak Kubin Tribe utilizes this mushroom as a food source. *Panus lecomtei* has a high carbohydrate content (Sharma et al., 2020). *Panus sribuabanensis* contains high protein and carbohydrates (Kumla et al., 2024). In addition, it is known that both species are low in fat content (Kumla et al., 2024; Sharma et al., 2020).

The Dayak Kubin Tribe knows *Psathyrella* sp. as *kulat nior*. They utilize this mushroom as a food ingredient and process it by stir-frying. Nutritional content analysis of several *Psathyrella* species has been conducted, such as *Psathyrella tuberculata* by Atchibri et al. (2017), which showed high protein content and very low-fat content.

The Dayak Kubin Tribe knows *Cookeina sulcipes* as *kulat mangkok*. The Dayak Kubin Tribe utilizes this mushroom species to eat by making it a mixture of soup or vegetables. *Cookeina sulcipes* contains high protein and low fat, so it can be concluded that this mushroom species can be used as a nutritious and healthy food source (Sánchez et al., 1995).

The Dayak Kubin Tribe knows *Cookeina tricholoma* as *kulat mangkok*. The utilization by the Dayak Kubin Tribe of this mushroom species is as a food ingredient. Like *Cookeina tricholoma*, this mushroom species is processed as a mixture of soup or vegetable ingredients. Assessment of nutritional content is very rarely done. However, it is known that *Cookeina tricholoma* contains β-D-glucans, which are a class of polysaccharides

(carbohydrates) that have potential as antinociceptives and immunomodulators (Moreno et al., 2016).

The Dayak Kubin Tribe knows *Schizophyllum commune* as *kulat taun*. This mushroom species is a mushroom species consumed by the Dayak Kubin Tribe. The processing of this mushroom species is stir-fried. *Schizophyllum commune* is a mushroom species used as a high nutritional food source, although the nutritional content depends on the type of wood that is the substrate (Yusran et al., 2023). The nutritional value of this mushroom species is related to its high carbohydrate, protein, fiber, and mineral content and its low-fat content (Singh et al., 2021).

The utilization of some mushroom species found in this research is similar to many other studies conducted in Indonesia, especially their utilization as food ingredients. This is the statement of Faturrahman & Yeni (2024) that the way mushroom species are utilized in an area can be similar or even the same as their utilization in other areas. Information on the utilization of several mushrooms in this research that were successfully identified to the species level, along with utilization in several other research within the last 10 years, can be seen in Table 3

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Table 3. Consumption use of several species within this research with several other research conducted in Indonesia

Species	Research Area	Reference
Auricularia auricula-judae	Lake Poso, Central Sulawesi	Yusran et al. (2024)
	Lore Lindu National Park, Central Sulawesi	Yusran et al. (2021)
	Pasangkayu District, West Sulawesi	Yusran, Erniwati, & Rukmi (2024)
	Saktu Island, Jakarta	Noverita et al. (2018)
	Semujan Hill, West Kalimantan	Juarsih et al. (2023)
	Tidore Udara District, North Maluku	Anwar et al. (2020)
	Toro Village, Central Sulawesi	Yusran et al. (2022)
Auricularia delicata	Saktu Island, Jakarta	Noverita et al. (2018)
Marasmiellus candidus	Semujan Hill, West Kalimantan	Juarsih et al. (2023)
Pleurotus cystidiosus	Selamanik Village, West Java	Zakiya et al. (2024)
Lentinus sajor-caju	Katingan Regency, Palangka Raya City, & Pulang Pisau Regency, Central Kalimantan	Nion et al. (2024)
	Lore Lindu National Park, Central Sulawesi	Yusran et al. (2021)
	Tidore Udara District, North Maluku	Anwar et al. (2020)
Cookeina sulcipes	Pulang Pisau Regency & Seruyan Regency, Central Kalimantan	Nion et al. (2024)
Cookeina tricholoma	Pasangkayu District, West Sulawesi	Yusran, Erniwati, & Rukmi (2024)
Schizophyllum commune	East Kotawaringin Regency, Palangka Raya City, & Pulang Pisau Regency, Central Sulawesi	Nion et al. (2024)
	Lake Poso, Central Sulawesi	Yusran et al. (2024)
	Lore Lindu National Park, Central Sulawesi	Yusran et al. (2021)
	Pasangkayu District, West Sulawesi	Yusran, Erniwati, & Rukmi (2024)
	Tidore Udara District, North Maluku	Anwar et al. (2020)
	Toro Village, Central Sulawesi	Yusran et al. (2022)

Figure 4. Mushrooms sold in traditional markets

The Dayak Kubin Tribe that inhabits Nanga Raku Village also makes mushrooms their livelihood by selling them in traditional markets (Figure 4). The high nutritional content of mushrooms makes them a valuable food source. In addition, mushrooms contain many bioactive compounds that play a role in the health sector (Sharma et al., 2024). Based on these two factors, mushrooms are a commodity the public seeks in the market (Yusran et al., 2021).

The research provides a comprehensive account of the Dayak Kubin Tribe's use of mushrooms, detailing specific species and their applications in food and medicine. This contributes new knowledge to the field of ethnomycology and highlights the tribe's unique cultural practices. The research contributes to the scientific understanding of the nutritional and medicinal benefits of mushrooms. By documenting the traditional knowledge of the Dayak Kubin Tribe, the research supports efforts to preserve biodiversity and cultural heritage. It emphasizes the importance of sustainable practices in mushroom foraging and utilization, which can have long-term benefits for both the local community and broader ecological systems.

CONCLUSION

Based on the research conducted, it can be concluded that the Dayak Kubin Tribe in Nanga Raku Village uses 16 species of mushrooms in their daily lives. The mushrooms come from 11 families, namely Agaricaceae, Auriculariaceae, Hygrophoraceae, Lyophyllaceae, Marasmiaceae, Omphalotaceae, Pleurotaceae, Polyporaceae, Psathyrellaceae, Sarcoscyphaceae, and Schizophyllaceae. Mushroom species used as food sources are *Agaricus* sp., *Auricularia auricula-judae*, *Auricularia delicata*, *Termitomyces* sp., *Lactocollybia* sp., *Marasmiellus candidus*, *Pleurotus cystidiosus*, *Lentinus sajor-caju*, *Panus* sp., *Psathyrella* sp., *Cookeina sulcipes*, *Cookeina tricholoma*, and *Schizophyllum commune*. Mushroom species utilized as medicines are *Microporus affinis* and *Microporus xanthopus*. *Hygrocybe* sp. is the only mushroom species that is used as a food source and medicinal ingredient. The results of this research become a document that complements ethnomycological information, especially by tribes in West Kalimantan.

This research suggests several avenues for future research, including the need for more detailed biochemical analyses of the identified mushroom species to understand their nutritional and medicinal properties better. Additionally, further exploration into sustainable harvesting practices and the potential impacts of environmental changes on mushroom availability could provide valuable insights. Future research could also include comparative studies with other indigenous communities to enrich the understanding of ethnomycological practices globally.

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