

LOCAL KNOWLEDGE OF EDIBLE GELAM MUSHROOM IN TERENGGANU

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Abstract: The edible wild boletoid mushroom *Tylopilus griseipurpureus*, or locally known as gelam mushroom (as it grows near gelam trees), has been uniquely consumed by local communities in Setiu and Besut in Terengganu, Malaysia. However, knowledge of this mushroom is poorly documented. Therefore, this study attempted to document the local knowledge on the consumption of *T. griseipurpureus* in two districts of the state. Members of selected local communities were interviewed to obtain information on the fungus' fruiting season, utilization and economic perspectives. *T. griseipurpureus* samples were also collected during its fruiting season. Overall, 38 respondents were interviewed, where women and the older generation were found to have better experience in handling the mushroom like collecting and cooking them. Majority of respondents said *T. griseipurpureus* fruiting bodies could be harvested between May and July, when heavy rain starts to fall after the hot season from the beginning of the year ends. The recipe of making *kerabu kulat gelam* and other ways of preparing dishes with this mushroom were recorded. The price of both fresh and boiled gelam mushrooms were also surveyed at local markets. The additional notes on the fruiting season, utilization and economical aspects of gelam mushroom in this study might provide better understanding on the ethnomycological aspects of the species.

Keywords: Ethnomycology, bolete, gelam mushroom, *Tylopilus griseipurpureus*, sustainability.

Introduction

Ethnomycology is the study of fungal utilization by humans or the relationship between traditional societies and fungi (Cardoso *et al.*, 2010; Malaisse *et al.*, 2012; Kik *et al.*, 2013). The ethnomycological field also investigates the consumption of mushrooms by humans, focusing on their nutritional and medicinal aspects, as well as the ectomycorrhizal relationship and ecological benefits of macrofungi to the environment (Kinge *et al.*, 2017). Ethnomycological knowledge also combines the biological resources, cultural and traditional practices of society that focus on the uses and essential roles of fungi in daily life (Foo *et al.*, 2018).

The utilization of wild mushrooms has been widely studied in many countries, including India (Dutta & Acharya, 2014; Kumar *et al.*, 2017), China (Kang *et al.*, 2016), Cameroon (Dijk *et al.*, 2003; Yongabi *et al.*, 2004; Kinge

et al., 2017) and the Philippines (De Leon *et al.*, 2013; Lazo *et al.*, 2015). In Malaysia, wild mushrooms have been widely used as food by indigenous and local communities. They use it as soup flavouring (Chong *et al.*, 2007) and it also improves the taste and texture of dishes (Chye *et al.*, 2008).

This unique and excellent flavour, known as umami, is also called the "palatable taste" and is one of the five recognised tastes besides sweet, sour, salty and bitterness. Umami may stimulate appetite and is the taste receptors' response to glutamates, which are present in meat broths and fermented products. That taste may also be introduced into food by adding monosodium glutamate.

Mushrooms are suitable condiments for meat, seafood, stew, soup and vegetable dishes (Mau, 2005). People greatly appreciate them for their pleasant fruity aroma (Chye *et al.*, 2008). Lee *et al.* (2009) documented the utilization of

31 wild mushrooms as food and another 14 for medicinal purposes by indigenous communities in Peninsular Malaysia. In addition, Mohammad & Hamzah (2015) recorded 10 macrofungi species that are utilized as food and medicine by the Bateq sub-tribe in Kampung Orang Asli Kuala Koh, Kelantan, in which the method of usage for each sample is detailed in their report. Meanwhile, Foo *et al.* (2018) reported 25 wild mushroom species as being edible and five that have potential medicinal uses by four ethnic communities in Sabah (Northern Borneo). Despite the ethnomycology studies that have been conducted in Malaysia (Chang & Lee, 2004; Lee *et al.*, 2009; Abdullah & Rusea, 2009; Foo *et al.*, 2018), it is still believed that the documentation on mushroom utilisation as food and medicine is still sparse and limited.

The boletoid fungi are members of the Boletaceae family under the phylum Basidiomycota in the Fungi kingdom (Eumycota). Fungi that belong to this group are associated with nearby tree roots and form mutual relationships with other plants known as mycorrhizae (Kuo, 2013). *T. griseipurpureus* has been identified as a bolete species found in Setiu and Besut districts of Terengganu (Lee, unpublished). It is widely collected by locals and made into delicacies during its annual fruiting season from May to July. The fungus is locally known as *kulat gelam* because it tends

to grow near paperbark trees (*pokok gelam*) (*Melaleuca cajuputi*) in the sandy beach ridges (BRIS) of Kelantan and Terengganu (Figure 1) (Lee, unpublished).

Morphologically, this fungus is grey to violet white when young, and turns brown or reddish-brown with age. Its pileus (cap) is smooth and either convex or plane shaped, which sometimes may look powdery. The stipe (stalk) is either clavate or cylindrical, with reticulated patterns on the surface. The hymenophore of the gelam mushroom is made up of tubular pores, which is white when young and turns pale brown with age. In the forest area dominated by *M. cajuputi*, it can be found growing on soil near the trees, which is mostly covered with leaf litter (Figure 2).

T. griseipurpureus is reportedly a favourite edible wild mushroom found in Bachok, Kelantan, and South Thailand (Aung-aud-chariya *et al.*, 2012; Angajchariya *et al.* 2017; Lau *et al.*, 2017). Early studies have documented the mushrooms in Kelantan and Thailand as *Boletus griseipurpureus*. But later, the taxonomic name has been changed to *T. griseipurpureus* according to Index Fungorum (2020) and the Mycobank Database (2019).

To date, not much knowledge regarding this edible boletoid species in Malaysia has been documented. Thus, this study aims to document the local knowledge in utilizing and consuming



Figure 1: Paperbark trees (*Melaleuca cajuputi*) growing in a forest near a beach in Terengganu



Figure 2: Mature gelam mushrooms found in its habitat

gelam mushrooms by local communities in Setiu and Besut districts of Terengganu.

Materials and Methods

Study areas and sample collection

The study was conducted in Setiu and Besut districts in Malaysia’s northeastern state of Terengganu during the fruiting season from April to July 2019 (Figure 3). Local areas, such as Gong Batu, Pengkalan Gelap, Telaga Papan and Telaga Papan Baru, where the communities were known to be involved in gelam mushroom collection, were visited to conduct interviews and collect samples. Villagers were also roped in to help identify the morphology of

T. griseipurpureus growing in the wild and the location of paperbark tree forests where it was usually collected. Besides that, selected wet markets that sold *T. griseipurpureus* were also visited, namely the Kampung Mangkok market (5.605591 N, 102.816352 E) in Setiu district, and the Kuala Besut wholesale market (5.810880 N, 102.544103 E) and Besut farmers’ market (5.830194 N, 102.550114 E) in Besut district.

Each study area in Setiu and Besut were visited once every week during the study period, and mushrooms were collected particularly in Gong Batu, Pengkalan Gelap, Telaga Papan and Telaga Papan Baru with the help of local villagers.

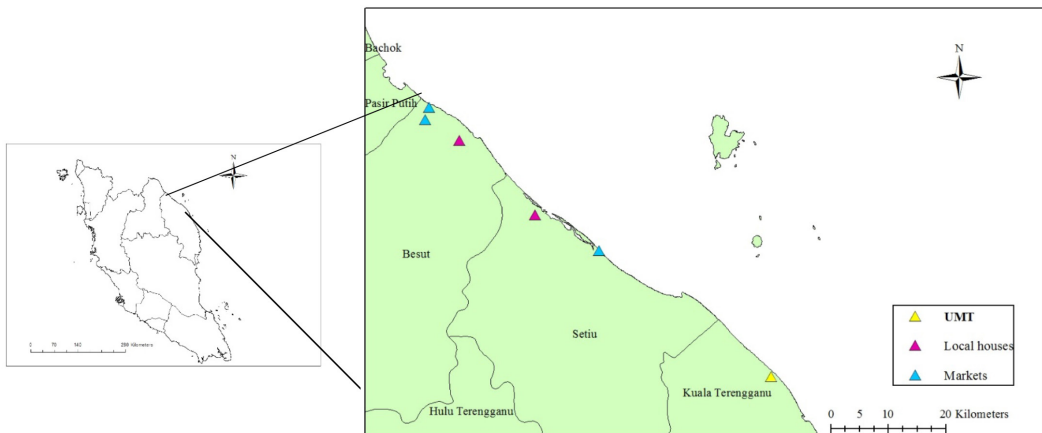


Figure 3: Location of markets and houses in Setiu and Besut districts of Terengganu visited for *T. griseipurpureus* sample collection

Sampling frame

An ethnomycological survey was carried out through interviews. Snowball sampling was used to gather more respondents and a set of questions was prepared and presented before sample collections. The interview questions assessed the respondents' knowledge in identifying the mushroom's characteristics, its fruiting season, utilization and economic aspects.

The respondents were chosen based on their experience in collecting, buying and cooking the mushroom. Verbal consent was obtained to use and publish the information they provided (Figure 4). Greengrocers at selected wet markets and their customers were also interviewed (Figure 5). The demographic data of respondents were summarized and presented in graphs.

Results and Discussion

Demographic Profile

A total of 38 respondents comprising 10 males and 28 females were interviewed, where 18 were from Setiu (five males, 13 females) and 20 were from Besut (five males, 15 females). The number of respondents according to gender is shown in Figure 6. Overall, there were more females interviewed (74%) than males. Based on interviews with locals, both men and women were involved in the mushroom collection. However, women had more knowledge in utilising the mushrooms. According to Lee *et al.* (2009), women played a crucial role in orally passing the indigenous knowledge on the mushroom to the younger generation. Women also tended to be involved in every economic aspect, from mushroom collection to processing and selling, besides cooking them to feed their families (Garibay-Orijel *et al.*, 2012).



Figure 4: Interviewing a local resident on his knowledge in collecting and utilising *T. griseipurpureus*



Figure 5: Interview with a greengrocer at a wet market

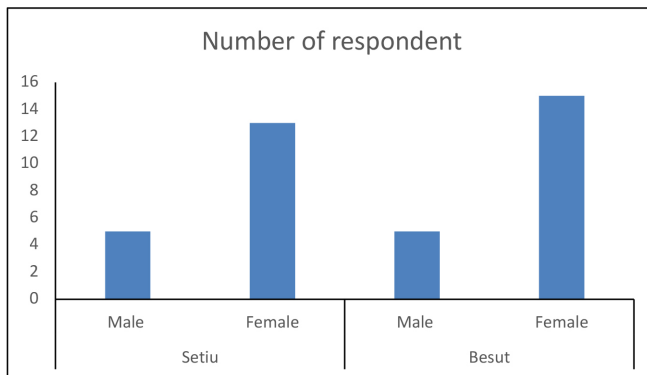


Figure 6: Number of respondents interviewed according to gender

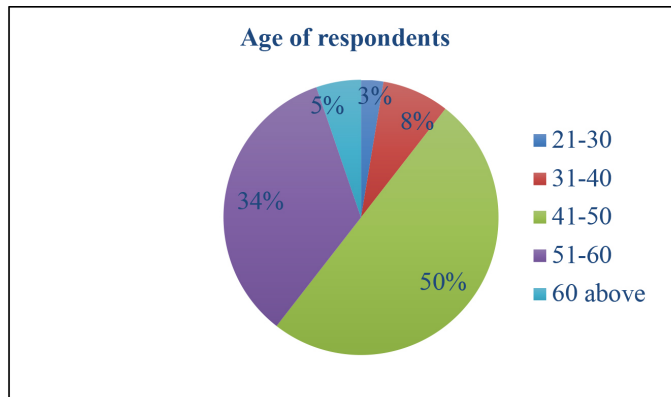


Figure 7: Percentage of respondents in different age groups (21-30 years old, 31-40 years old, 41-50 years old, 51-60 years old and above 60)

The age of respondents ranged from 21 to 70, where the majority 50 % were between age 41 and 50. This was followed by those aged 51 to 60 (34 %) and other age groups (16 %). Although most respondents were middle-aged, the interviews suggested that the elderly tended to have prominent knowledge on utilization of the mushroom. Studies had shown that the older generation was very knowledgeable because they had more exposure and opportunities to utilise *T. griseipurpureus* in different ways throughout their lifetime (Lazo *et al.*, 2015; Foo *et al.*, 2018; Teke *et al.*, 2018). The percentage of respondents in different age groups is shown in Figure 7. The younger generation tended to have little knowledge about the gelam mushroom's use compared to older generations. This was congruent with the study done by Lin (2005), which stated that the younger generation was more interested in migrating to cities to earn more income rather than learning about the mushroom trade. The urbanisation of local communities had also reduced the chances of retaining this traditional knowledge to pass down to future generations (Chang & Lee, 2004; Lee *et al.*, 2009).

Local Knowledge on Mushroom Fruiting Season

Local villagers would collect gelam mushrooms in forests dominated by paperbark trees. In the interviews, the respondents mostly emphasized

the seasonal period as an indicator on when to collect the mushrooms. More than half of the respondents stated that a prolonged hot weather of several months, followed by heavy rainfall, would provide a conducive environment for the fruiting of this mushroom, and 34.2 % of them said May to July was the peak fruiting season. However, they believed that the period could vary according to the weather.

The peak fruiting period of gelam mushrooms reported by Lau *et al.* (2017) in Kelantan differed slightly with this study, which was from June to September annually. Meanwhile, another recent study on gelam mushrooms in Besut reported that they could be found only in March or July, and in small quantities in December due to the rainy season and high humidity (Awang *et al.* 2018). Generally, according to Hussein *et al.* (2016), wild edible mushrooms were best collected during the rainy season. Temperature, rainfall and humidity levels were main factors that affected the fructification of mushrooms (Giri & Rana, 2008).

Local Knowledge on Mushroom Culinary (Thematic Analysis)

All respondents said they consumed *T. griseipurpureus* as food. Mushrooms had been identified as a health food because of its high nutrient content (Cheung, 2010). The respondents consumed gelam mushrooms

because they found it to be palatable. This study recorded several ways on how the respondents ate gelam mushrooms, particularly in making kerabu and by dipping it in sauces or other condiments.

'Kerabu Kulat Gelam'

The most popular dish that used gelam mushroom was *kerabu*, a local salad. All respondents said this was the most common way to consume the mushroom. A local recipe was obtained from one respondent in Setiu (Pok Rizam, personal communication). First, the mushrooms were cleaned and washed. The base was cut off before the mushrooms were sliced into smaller pieces. Then, they were boiled for about 15 to 20 minutes with a little bit of salt.

Other ingredients included fish, young mangoes, dried shrimps, chilies, ginger, onion, cashew nuts, chives, Vietnamese coriander, coconut milk and grated coconut. The amount of ingredients were prepared in rough proportions based on the number of servings, and could be adjusted according to preference.

The onions and ginger were cut and crushed into paste. Similarly, the fish, after being cleaned, boiled and de-boned, was pounded into paste. The sliced gelam mushrooms, mangoes, chilies, chives and Vietnamese coriander were placed in a big bowl with crushed cashew nuts, and mixed with a small amount of coconut milk and grated coconut. All ingredients were stirred evenly before being served with a bit of salt and sugar as seasoning.

Dipping in Sauces

The other way to consume gelam mushroom was by dipping it in sauces like *air asam* (a mixture of tamarind juice, tomatoes, onion and chilies), *sambal belacan* (a mixture of chili paste, blended onion and garlic with lime juice) or *budu* (a local fermented fish sauce). Locals preferred to consume this together with rice.

Other Methods of Consumption

A respondent from Setiu said she usually stir-fried gelam mushrooms with cabbage, carrots and broccoli (Wee, personal communication). Another respondent from Besut preferred to boil the mushroom in soup with cauliflower, carrots and cabbage since he enjoyed the tinge of the mushroom's bitterness.

There were locals who believed that gelam mushroom could help keep diabetes in control (Pok Ku *et al.*, personal communication). However, there were no respondents who were personally taking the mushroom for such purpose. They also said the mushroom was not suitable for people with high blood pressure as eating it with medicine could cause dizziness. Thus, further scientific research would be required to investigate the medicinal properties of gelam mushroom.

Local Knowledge on the Mushroom Market

T. griseipurpureus was widely collected by locals to sell to middlemen from the neighbouring state of Kelantan, while others were for home consumption. One respondent (Pok Din, personal communication) claimed that the recipe to prepare *T. griseipurpureus* originated from Kelantan. Therefore, Kelantanese people in Setiu and Besut tended to buy the mushroom when it was on season.

The fresh mushrooms cost around RM6 to RM8 per kilogram, while boiled mushrooms in packets found at local wet markets were priced between RM 3 and RM4. This provided an additional source of income to local communities (Yongabi *et al.*, 2004; Lazo *et al.*, 2015). More than 17 mushroom species were known to be cultivated in Malaysia, and the grey oyster mushroom had the best demand for household consumption (Haimid *et al.*, 2013; Amin *et al.*, 2014; Rosmiza *et al.*, 2016). Compared to gelam mushrooms, grey oyster mushrooms had better value as its market price ranged between RM7 and RM10 per kilogram, while retail price could range from RM12 to RM15 per kilogram (Haimid *et al.*, 2013).

Conclusion

This study had documented local knowledge of gelam mushroom in terms of its growth, utilization, consumption and economic aspects. Further studies could be conducted to explore the biological activities of this edible bolete, such as its antimicrobial, antibacterial and anticancer properties. Studies could also focus on boosting the market value of *T. griseipurpureus* to bring it on a par with other mushrooms. Since the utilization of *T. griseipurpureus* was limited because it was only found in *Melaleuca* forests within the Beach Ridges Interspersed with Swales (BRIS) soil in the coasts of Terengganu and Kelantan, it is imperative to preserve the local knowledge and conserve the species.

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