

## Wild pepper species consumed as green leafy vegetables among Orang Ulu groups in Asap-Koyan Belaga, Sarawak

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### Abstract

Wild pepper plants are a valuable food source, particularly to the Sarawak local community living in rural areas. However, these plants remain unknown to the public due to the lack of scientific information disseminated to the public, and there is a rapid decline in traditional knowledge on edible plants from natural resources. The documentation and evaluation of traditional knowledge related to the diversity and usage of wild pepper plants are crucial. Therefore, this study was aimed to document and evaluate the species from Piperaceae vegetables as a food source among the Orang Ulu community in Belaga, Sarawak. Face-to-face interviews involving thirty respondents from Sungai Asap-Koyan, Belaga, Sarawak were conducted. This was to gather information on the diversity, distribution, usage, consumption and perception of wild pepper plants. From the results, wild peppers species commonly consumed were *Piper umbellatum*, *P. borneense*, *P. auritifolium* and *P. rueckeri*. Among the species, *P. borneense* var 1 and *P. umbellatum* showed significant distribution in the area. The consumption of wild pepper as leafy vegetables is common among the community as they prefer the taste, aroma, and due to their belief in its nutritional values and medicinal properties. The plant is also used as an additive in cooking, and it is widely accepted among the community. It has the potential to be commercialized and introduced as a food crop. Future studies should be conducted to assess and apply ethnic knowledge for improved performance of *Piper* species consumption among larger communities.

## 1. Introduction

The use of wild plants as a source of food, especially among remote communities in the rural area is an integral part of the culture and traditions of indigenous people around the world. Most people living in interior areas meet their nutritional needs using unconventional means, by consuming a variety of wild plants and animals from natural sources. Based on statistics of all developing countries, there are still millions of people dependent and earning their living income from wild plant products (Schippmann, 2002). Wild vegetables are an important component of dietary variation and lead to the food security of most ethnic households whose lives are much more difficult in rural areas (Nurul Izzah *et al.*, 2012). Vegetable from natural forest commonly used is Zingiberaceae, Poaceae, Arecaceae and Piperaceae. *Piper* is a well-distributed species among the Piperaceae

genus in the pantropical and neotropical regions, with about 1200 species and over 400 species recorded from the Malesian region alone (de Waard and Anunciado, 1999). A study on Piperaceae in Peninsular Malaysia recorded 75 species (Ridley, 1924), Philippines has documented 87 species of *Piper* (Quisumbing, 1930; Gardner, 2006) and Thailand only 46 species and two varieties (Suwanphakdee *et al.*, 2020). However, in East Malaysia, there is a lack of records on Piperaceae, mostly because of the difficulty in plant identification.

The most popular uses of *Piper* in Malaysia are as spices and food (Tawan *et al.*, 2002) which include cultivated *Piper nigrum* L. (Lada Hitam) which became one of the primary sources of spices worldwide. *P. betle* (Sireh) are used for masticatory and *P. sarmentosum* Roxb. (Kadok) as a decoction and to relieve childrens' sickness. All these useful pepper plants are collected

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from lowland forests, hill forests, disturbed and established secondary forests. Other species used for medicinal purposes included *P. umbellatum* (Segumbar urat) for stomachaches, and its fruits were chewed with betel for coughs. *P. poryphyrophyllum* (Sireh harimau or Akar bugu) leaves were also eaten raw or cooked as a seasoning, a pretty wild *Piper* with purple and speckled leaves that were purportedly effective against leprosy, stomach-aches in children and a variety of skin diseases (Tawan *et al.*, 2002). Southeast Asian people use *P. vestitum* leaves and fruits as an antidote for Ipoh poisoning by rubbing on the injured part (Chen *et al.*, 2018).

Currently, global food sources are from less than 30 species which accounts for 90% of the needs from domesticated plants. Dependence on crops that have been domesticated in society has changed many abiotic conditions in the natural habitat of the plants, and edible plants in the wild have been neglected before their potential as a source of food to humans is known. Wild edible plants can significantly increase food sustainability by reducing the risk of dependence on a limited number of crops (Konsam *et al.*, 2016). Despite the importance of wild edible pepper plants as a valuable food, most of these plants remain unknown to the public due to the lack of scientific information disseminated to the public. Many wild edible pepper plants collected from forest areas are limited to certain areas or community's knowledge. The diffusion of foreign food culture and the availability of readily available raw food sources have formed a cultural heritage of different communities and caused many of the local food cultures to be increasingly forgotten (Konsam *et al.*, 2016).

Given the rapid decline of traditional knowledge about edible plants from natural sources and the increasing dependence on processed foods, the documentation and evaluation of traditional knowledge related to the diversity, use and status of wild edible pepper plants is crucial to be studied. Several studies on food crops and ethnomedicinal have been done at a high level either in universities or in agriculture-related agencies in Malaysia, but the information is limited to wild vegetables that are commonly used today. The species of pepper plants species that can be eaten from wild sources are believed undocumented. The diversity of wild *Piper* species that are useful in society needs to be screened out as new sources of vegetables now and for the future to be considered as healthy food. Inventory of wild food resources, ethnobotanical information on diversity, consumption, status and food plant evaluation as an alternative is important.

The objective of this study was to document and evaluate the species from Piperaceae consumed as a

leafy vegetable as a food source to the Orang Ulu community in Sarawak. It also aimed to provide systematic information on which species needs to be given priority in this family through integrated assessment as well as the perception of its nutrition.

## 2. Materials and methods

### 2.1 Study site and data collection procedure

The study was conducted at one of the Orang Ulu settlements at Sungai Asap-Koyan, Belaga, Sarawak from 14 March to 5 April 2020. The methods employed in this study were designed for collecting baseline information on the diversity and usage of wild pepper resources locally used by ethnic groups of Orang Ulu in Asap-Koyan, Belaga. Face-to-face interviews were carried out involving 30 respondents (Omar *et al.*, 2016; Saupi *et al.*, 2020). Respondents involved in this study ranged in age from 22 years to 88 years with eight males and 22 females. The majority of the respondents of this study were also farmers (86.7%) and the others were those working with government and private agencies (13.3%) who knew about the use of wild pepper as a food source and its advantages in nutrition.

Selected respondents in the community helped guide the researchers to visit the location of the existing plants in the forest, including virgin forest areas and forest that has been disturbed for more than 10 years named as logged-over forest, forest edge of oil palm plantation and secondary forest or former hill paddy cultivation areas. This was to collect information related to the wild pepper species and their distribution. Global positioning system readings were also recorded for plant species distribution mapping purposes (Lepun and Alan, 2017). During the data collection of plants, some parts of the plants were gathered as samples for food preparation by experienced field assistants.

The respondents were also asked about the consumption and perceptions of wild peppers from the local community perspectives. For a systematic approach to integrated assessment, ten evaluation criteria were selected which were considered important to determine the value of wild edible pepper, and a score was assigned to each of them. These are usage status, distribution, life form, basis of civil use, growth area, edible time, edible part, taste, medicinal value and market potential. Analysis of respondents' food perception and the acceptance of these pepper plants are based on their knowledge of the plant and usability. The qualitative data obtained from the respondents in the interviews were documented in table form.

### 3. Results and discussion

#### 3.1 Wild pepper distribution and vegetable collection

A total of four species of wild peppers have been identified as leafy green vegetables consumed by the Orang Ulu community in Belaga, Sarawak, namely *Piper umbellatum*, *P. borneense*, *P. auritifolium* and *P. rueckeri*. Table 1 shows the local names, the scientific names, edible parts and the importance of use. The Orang Ulu groups consumed these pepper species not only as a food source but also due to their nutritional value and benefits in helping to increase the body's immune system against diseases such as malaria, constipation, and heat and toxin remover.

Figure 1 shows the growth habit of *Piper borneense* var. 1 in the wild, and Figure 2 shows the inflorescence which was red and of the short peduncle. Figure 3 shows a fruiting *Piper borneense* var. 2, while Figure 4 shows its yellow greenish inflorescence. A *Piper borneense* var. 3 growing on the rocky area was shown in Figure 5, while its inflorescence of orange colour and long peduncle was shown in Figure 6. For food preparation, the whole parts of *P. borneense* for all three varieties can be collected, because all parts are succulent. Figures 7 and 8 show *Piper umbellatum* growing on the roadside of logging area in Lusong Laku, Belaga, while Figure 9 shows *Piper auritifolium* growing on the edge of an abundant secondary forest area. *P. rueckeri*, a shrubby type of *Piper*, was shown in Figures 10 and 11. For *P. umbellatum*, *P. auritifolium* and *P. rueckeri*, only young leaves, stems and flowers were collected and used for cuisine preparation. When the villagers went into the forest for animal hunting, rattan and agarwood collecting, or any other work that needs an overnight stay, they would gather these plants as one of their options for food to gain energy and avoid getting sick. The leaves of a wild pepper plant in the forest were eaten

to maintain health and body immunity.

Figure 12 shows the distribution of *Piper* species consumed by Orang Ulu in Belaga, Sarawak. Based on the population growth, *P. borneense* var 1 and *P. umbellatum* showed a significant status due to their excellent distribution. Both species were commonly consumed as green leafy vegetables for food because they were easy to be found and grew in very large numbers or bigger clumps. For the species *P. borneense* var 1, *P. borneense* var 2, *P. auritifolium* and *P. rueckeri*, they grew in very small numbers. This shows that their distribution is very rare in the Asap Koyan Belaga area because their growth properties are also very limited in terms of ecology types. *Piper* species growth response in forests is highly dependent on soil conditions as well as the light obtained. In each of the naturally occurring forests, each pepper species shows a very different growth response. *P. umbellatum* and *P. borneense* var 1 are species that showed the ability to take advantage of high light intensity conditions. *P. auritifolium*, *P. borneense* var 3 and *P. rueckeri* showed good growth in areas of moderate light intensity especially in areas of small growth gap, while *P. borneense* var 2 is more likely to survive in very low light conditions and this reaction is related to its morphological properties. Most forest pepper species such as *P. borneense*, *P. auritifolium* and *P. rueckeri* are found growing in various habitats and environments in Sungai Asap Koyan, Belaga, while *P. umbellatum* habitat is more of a highland area that is more related to volcanic soil such as in Usun Apau area namely Ulu Sungai Danum and Lusong Laku in Ulu Linau area.

#### 3.2 Wild pepper consumption and perception

Orang Ulu people of the Sarawak state are traditionally dependent on wild plant resources for various cultures in life since ancient times. The

Table 1. *Piper* species, local names, edible parts and importance of use

No.	Local Name	Scientific Name	Habit	Light Intensity	Edible Part(s)	Importance of use
1	Tung Burong Baleng	<i>Piper borneense</i> var 1	Herb	Low	Stem, leaves and inflorescence	Haemorrhoids, constipation, heat and toxins remover
2	Tung Burong	<i>Piper borneense</i> var 2	Herb	Moderate	Stem, leaves and inflorescence	Haemorrhoids, constipation, heat and toxins remover
3	Tung Burong	<i>Piper borneense</i> var 3	Herb	Moderate	Stem, leaves and inflorescence	Haemorrhoids, constipation, heat and toxins remover
4	Jalang	<i>Piper umbellatum</i>	Shrub	High	Young stem, leaves and inflorescence	Increase antibody against malaria, internal energy and toxins remover
5	Tung Burong, Daun Baleng	<i>Piper auritifolium</i>	Herb to Shrub	High	Young stem, leaves and inflorescence	Haemorrhoids, constipation, heat and toxins remover
6	Tung Burong	<i>Piper rueckeri</i>	Shrub	Moderate	Young stem, leaves and inflorescence	Haemorrhoids, constipation, heat and toxins remover



Figure 1. Growth habits of *Piper borneense* var. 1. on riverine area with big clump



Figure 2. *Piper borneense* var. 1 inflorescences always red in colour



Figure 3. *Piper borneense* var. 2. growth in a single stem



Figure 4. *Piper borneense* var. 2 inflorescences in yellowish-green



Figure 5. *Piper borneense* var. 3. growing on rock crevices

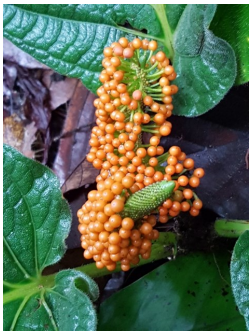


Figure 6. *Piper borneense* var. 3 inflorescences in orange



Figure 7. *Piper umbellatum* growing on black soil



Figure 8. *Piper umbellatum* stem and inflorescence



Figure 9. *Piper auritifolium* growing on high organic soils



Figure 10. *Piper rueckeri* growing on steep slope



Figure 11. *Piper rueckeri* stem

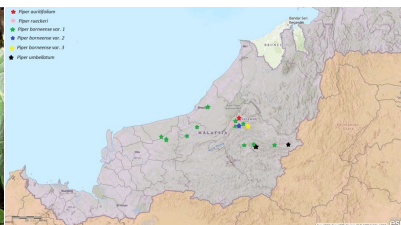


Figure 12. Distribution of *Piper* species consumed by Orang Ulu in Belaga, Sarawak

utilization of leafy vegetables among Orang Ulu is part of their cultural heritage and the plants play important roles in their customs, traditions and food culture in their households. Vegetables from herbaceous plants are eaten as one of the supporting food or as main dishes. Table 2 shows the integrated assessment and perceptions on wild pepper species in Asap-Koyan, Belaga. Based on the findings of this study, wild pepper *P. borneense* var. 1 was dominantly used among the Orang Ulu in Asap-Koyan Belaga. This is probably because this species is widely distributed around the area. The use of pepper species in traditional food is due to its succulent growth factors and fragrant aroma, bitter or bland (Edema, 1987; Mensah *et al.*, 2008).

The state of Sarawak is rich in a variety of traditional vegetables from the forest, and there are various types of cuisine by various ethnicities. The different wild pepper types are not the main source of food for the local

community compared to starchy foods that make up most of the staple food, but they are still eaten due to the content of vitamins, essential amino acids, as well as minerals and antioxidants (Mnzava, 1997; Fasuyi, 2006). Consumption of vegetables from natural sources is the cheapest and most accessible source of protein, vitamins, minerals and essential amino acids (Okafor, 1983). Forest vegetables are widely eaten because of their nutritional value which helps in recovery for the sick, and internal recovery due to their medicinal properties. All species of leafy pepper vegetables from *P. borneense*, *P. umbellatum*, *P. auritifolium* and *P. rueckeri* have medicinal benefits that makes them important in the nutrition for the local community. According to Dinehart *et al.* (2006), there is a strong correlation between the bitterness of sensory deterrent for vegetable selection and consumption with the reason for the selection of vegetables used for medical purposes.

Based on the results of this study, the consumption of wild pepper species is high for the residents of Sungai Asap-Koyan, Belaga. This is because they believe in its high medical value and help in health care. The health-promoting properties of vegetables other than fruits depend on elements such as vitamins, minerals, antioxidants and fibre (Angelino *et al.*, 2019). They also believe that the acceptance of forest pepper species as a green leafy vegetable is due to its health-promoting

Table 2. Integrated assessment and perceptions on wild pepper species in Asap-Koyan Belaga Sarawak.

Measures	<i>Piper borneense</i> var 1 (Tung Burong Baleng)	<i>Piper borneense</i> var 2 (Tung Burong)	<i>Piper borneense</i> var 3 (Tung Burong)	<i>Piper</i> <i>umbellatum</i> (Jalang)	<i>Piper</i> <i>auritifolium</i> (Tung Burong, Daun Baleng)	<i>Piper rueckeri</i> (Tung Burong)
Usage status	Dominant	Rare	Common	Common	Rare	Rare
Distribution	Wide range	Selected	Selected	Localize	Selected	Selected
Life form	Perennial succulent	Perennial succulent	Perennial succulent	Perennial shrub	Perennial shrub	Perennial shrub
Basis of civil use	Wide range	Rare	Common	Common	Rare	Rare
Growth area	Wide range	Mineral soil	Rocky	Volcanic	Rocky	Rocky
Edible time	All time	Sometimes	All time	Seasonal	Sometimes	Sometimes
Edible part	Multiple	Multiple	Multiple	Young part	Young part	Young part
Taste/flavour	Most preferred	Occasionally used	Most preferred	Most preferred	Occasionally used	Occasionally used
Medicinal value	Yes	Yes	Yes	Well known	Yes	Yes
Healthy food	Well known	Yes	Yes	Well known	Yes	Yes
Appearance, texture and colour	Most preferred	Occasionally used	Occasionally used	Most preferred	Occasionally used	Occasionally used
Aroma/Smell Rating	Most preferred	Occasionally used	Occasionally used	Most preferred	Occasionally used	Occasionally used
Knowledge menus	Well known	Yes	Yes	Well known	Yes	Yes
Market potential	High	Low	General	High	Low	General
Overall Acceptability	High	Low	High	High	Low	Low

properties, texture and colour. Plant-based diets have been demonstrated to provide potential benefits for cardiovascular and metabolic health (Kahleova *et al.*, 2017). The residents also consume wild pepper species due to their fragrant aroma. The local community hope that one day vegetables from wild pepper species will be accepted by other communities because as of late many people know how to use this species as an additive in cooking. Its potential for sale in the local market is also promising because generally, the communities know how to consume vegetable.

#### 4. Conclusion

In conclusion, wild pepper species *Piper umbellatum*, *P. borneense*, *P. auritifolium* and *P. rueckeri* are an excellent source of green leafy vegetables to be promoted for consumption, as it has been an important food source among the Orang Ulu community in Sarawak. The *P. borneense* var 1 was the most used plant by the communities because it is easily obtainable, its favourable characteristics, pleasant taste and the belief surrounding its potential to prevent haemorrhoids, constipation and to cool down the body. Consumption of vegetables from forest pepper species provide important nutrients for the body and the locals take advantage of it due to its high medicinal value and its fragrant smell. Nowadays, residents are increasingly skilled in using it as seasonings in their food menu, causing its acceptance to be better among the local community. Considering the

nutritional value, it has the potential to be commercialized and introduced as a food crop. As these wild pepper vegetables lack scientific data on nutrition content and agronomic requirements, future studies should be conducted to assess and apply ethnic knowledge in the community groups for improved performance of *Piper* species consumption among the community.

#### Conflict of interest

The authors declare no conflict of interest.

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