

Review: Traditional knowledge of the Dayak Tribe (Borneo) in the use of medicinal plants

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Abstract. Az-Zahra FR, Sari NLW, Saputry R, Nugroho GD, Sunarto, Pribadi T, Setyawan AD. 2021. Review: Traditional knowledge of the Dayak Tribe (Borneo) in the use of medicinal plants. *Biodiversitas* 22: 4633-4647. Dayak is the name for the native inhabitants of the island of Borneo. The Dayak Tribe uses natural and forest products in plants as traditional medicine for health treatment. This study aims to obtain information about the utilization of medicinal plants in the Dayak Tribe. The knowledge about traditional medicine by utilizing medicinal plants has been obtained from their ancestors since ancient times and inherited from generation to generation. The use of various medicinal plants used by the Dayak Tribe has differences in terms of the part of the plant taken, how to process it, and how to use it. This is because each Dayak Sub-tribe has its role model for using these medicinal plants. For example, the leaves are used in one area, and it could be that the plant roots are used in other areas. This paper reviews the use of medicinal plants to treat various diseases by 6 Dayak sub-tribes, namely: Desa Dayak Sub-tribe (member of Iban Dayak), Jangkang Dayak Sub-tribe (member of Klemantan Dayak), Bakumpai Dayak Sub-tribe (member of OtDanum-Ngaju Dayak), Kenyah Dayak Sub-tribe (member of Apokayan Dayak), Tagol Dayak Sub-tribe (member of Murut Dayak), and Siang Dayak Sub-tribe (member of Punan Dayak). The results from 6 Dayak Sub-tribes revealed 63 families of plants from which 133 species. The family most widely used for medicinal plants, namely Euphorbiaceae, consists of 9 species, and the leaf is the most commonly used part of the plants (47%). The traditional knowledge of the Dayak Tribe in utilizing plant resources will significantly help preserve biodiversity and domestication of medicinal plants. Suppose medicinal plants are exploited more than they should. In that case, it will undoubtedly have a significant impact on their availability in the forest area, and if it continues, it will cause the extinction of certain species. This implies the importance of preserving local wisdom in the Dayak Tribe so that the use of nature is done wisely and so that it remains sustainable. By knowing the benefits of medicinal plants, Dayak Tribe will want to conserve these medicinal plants to be used in the future.

Keywords: Borneo, Dayak Tribe, ethnobotany, Kalimantan, medicinal plants

INTRODUCTION

Indonesia's biodiversity is significant for the sustainability of the nation's life. This is not because Indonesia is one of the wealthiest countries globally in terms of biodiversity, but because it is closely related to local cultural diversity and traditional knowledge (Sujarwo et al. 2014). The relationship between biodiversity and local systems that live in the community can be seen in the daily life of traditional communities in meeting the needs for food, clothing, shelter, medicine, and spirituality (Khan et al. 2013; Matthew et al. 2013; Putri et al. 2016; Batoro et al. 2019; Rohman et al. 2019a,b; Panjaitan et al. 2020). These traditional and local ecological knowledge are valuable sources of information that get international recognition (Junior and Santos 2017).

Traditional medicine, which generally comes from plants, has been known for a long time. Traditional medicinal plants are natural ingredients that have

traditionally been used for treatment based on the experiences of local communities themselves (Ragragio et al. 2013; Balangcod and Balangcod 2015; Molina et al. 2015; Che et al. 2017; Hussain et al. 2019; Tounekti et al. 2019). Knowledge about traditional medicine is passed down from generation to generation by the ancestors of the Indonesian nation (Gruyal et al. 2014; Sabran et al. 2016; Ducusin 2017; Gaddy 2020).

Medicinal plants in Indonesia have been going on since ancient times and have even become a culture (Son et al. 2019). Although broadly the same, each region or ethnic group has its characteristics in terms of traditional medicine, this is triggered by natural conditions, especially the availability of medicinal plants in each region, as well as differences in culture and customs the background for the use of these medicinal plants (Jaiswal et al. 2016). Medicinal plants can be used from certain parts, including roots, stems, leaves, fruit, seed, and their excretions that

can heal or relieve pain (Fukuyama et al. 2012; Roslinda 2016; Sharma and Yadav 2017; Tantengco et al. 2018).

Kalimantan is the Indonesian region of Borneo, an island with a very high level of biodiversity due to its diverse ecosystems. There are seven different ecoregions in Borneo, i.e., (i) lowland rain forest, which covers most of the island; the other lowland areas are covered by (ii) heath forest (kerangas); (iii) peat swamp forest; (iv) freshwater swamp forest in the southwest; (v) mangrove forest in all coastal areas; (vi) there are also mountain rain forest highlands, which is located in the center and northeast of the island with the peak of Mount Kinabalu, Sabah; and (vii) in this region there are alpine meadows and bushes that consist of many endemic species (Setyawan 2010).

The diverse ecosystems in Kalimantan are home to a wealth of medicinal plants that the Dayak Tribe uses to treat various ailments. The traditional knowledge of various species of forest medicinal plants owned by the Dayak Tribe is invaluable, especially for developing health and industrial medicine (Cheikhoussef et al. 2011; Shosan et al. 2014; Haeruddin et al. 2017; Qamariah et al. 2020). In addition, the knowledge of traditional medicine and the use of medicinal plants is an essential element in increasing an individual's ability to have a healthy life (Panjaitan et al. 2013; Elfahmi et al. 2014; Sujarwo et al. 2015; Fitmawati et al. 2017; Setiawati et al. 2019). Therefore, efforts to spread the use of medicinal plants are needed.

Unfortunately, the knowledge about traditional medicine in the Dayak Tribe is currently threatened with extinction due to several reasons, namely: (i) the knowledge is eroded by the younger generation's lack of interest in learning medicinal plants and the diversity of medicinal plants used by their ancestors; (ii) the traditional knowledge is still conveyed orally and not well documented; (iii) the older generations who know traditional medicine is decreasing and only a few elders are conveying information about types of medicinal plants and their use techniques to their children; (iv) the influence of foreign cultures is starting to enter to the Dayak Tribe; (v) the influence of technological progress which is increasingly leaving traditional elements.

Dayak Tribe communities lack access to modern health care, and the loss of medicinal plant knowledge will be a massive loss for the Dayak Tribe because it will lower their health quality. As a result, the Dayak Tribe's tradition of using nearby plants for treatment or health care must be practiced and preserved. Therefore, this study aims to review the utilization of medicinal plants for the Dayak Tribe.

THE DAYAK TRIBE, THE NATIVE PEOPLE OF KALIMANTAN

The Indonesian Borneo (Kalimantan) is administratively divided into five provinces, namely: East Kalimantan with capital city of Samarinda, South Kalimantan with capital city of Banjarmasin, Central Kalimantan with capital city of

Palangka Raya, West Kalimantan with capital city of Pontianak, and North Kalimantan with capital city of Tanjung Selor. The northern part of Borneo Island belongs to Brunei Darussalam and Malaysia, consisting of Sabah and Sarawak (Britannica 2019).

Dayak is the name for indigenous communities which are the original inhabitants of the island of Borneo. Other than Borneo, there were no Dayaks on other islands. Kalimantan has about 15 million people, with the main components of the Malays, Dayaks, and Chinese. Dayak Tribe has several about 3-4 million, of which the largest group is the Iban Dayak consisting of 710,000 people living in the northwest of the island. In addition, there are also ethnicities of Javanese, Madurese, and Bugis in significant quantities (MacKinnon et al. 1996).

At first, the Dayak communities lived spread out along the rivers downstream and then inhabited the coast of the island of Borneo. However, when the Malays from Sumatra and the Land of the Melaka Peninsula came, the Dayaks moved away gradually farther into the interior of Kalimantan on the one hand. Historically, the Dayak Tribe had built a kingdom. The Dayak oral tradition is often called "Nansarunai Usak Jawa," a Nansarunai Dayak kingdom destroyed by Majapahit, estimated to have occurred between 1309-1389. This incident resulted in the Dayak Tribe being pushed and scattered, some entering the interior (Fridolin Ukur 1971). On the other hand, the Dayak community has a shifting cultivation tradition. From year to year, they look for forests considered fertile for farming and planting as a livelihood. Finally, for many years, almost all remote areas of Kalimantan have not been separated from the dwellings of the Dayak community (Darmadi 2017).

Since thousands of years ago, the Dayak community of Borneo has used technology and traditional knowledge, namely shifting cultivation to manage natural resources and biodiversity in the forest. They build and use specific steps as a strategy for the conservation of natural resources and the environment. At first, learn the limitations of natural resources, where excessive and unwise use will reduce their availability and sustainability. Traditional knowledge is the unique local knowledge owned by a particular culture or society. This knowledge is the accumulation of human knowledge and understanding of the universe, including the spiritual relationship with the Almighty, the relationship with nature, and relationship with humans, and it is reflected in language, organization, values, and law system, to be the ethics that govern the behavior of a society. Dayak Tribe always believes that there is a limitation of natural resources, thus requiring conservation, except for certain types of resource availability which exceed demand (Uluk et al. 2001). Review of the literature shows that people who intentionally build conservation strategy usually has limited natural resources and easy to decline. Therefore, the strengthening conservation strategies in the traditional culture are essential to help survive in the limited natural resources, especially when natural resources run out (Setyawan 2010).



Figure 1. The Dayak sociolinguistic map described by Tjilik Riwut in 1954 divided the Dayak groups into I. Ngaju, II. Apokayan, III. Iban, IV. Klemantan, V. Murut, VI. Punan, and VII. Ot Danum. Recently, OtDanum-Ngaju Dayaks have been categorized as one group

Dayak Tribe is divided into six major clusters, namely: Apokayan (Kenyah-Kayan-Bahau), generally living in the eastern part of Kalimantan, OtDanum-Ngaju in the southern part of Kalimantan, Iban (Sea Dayak) in the northwestern inland to the coastal area of Borneo, Klemantan (Land Dayak) in the northwest outback of Borneo, Murut in northern Borneo, and Punan (Penan) in the center to the east of Borneo (Lontaan 1975) (Figure 1). Every major cluster can be divided into several sub-tribes, so there are 405 sub-tribes among the Dayak Tribe, they have comparable rituals and cultures (Lontaan 1974). Dayak Tribe lives in groupings of spots/areas where they are domiciled, hence there are differences between them. They use ethnicity for naming particular entities, such as the river's name, the hero's name, and the realm's name. For example, Dayak rod Loepar is named after the Loepar trunk; Dayak Lebang is named after the Lebang river; Dayak Ketungau is named after the Mualang river; Dayak Seberuang is named after the Seberuang river; Dayak Tidung is named after the Tidung river; and Dayak Hill (Kanayatn/Ahe) is named after the Bawang Hill (Darmadi 2017).

Dayak Tribe has a loose grouping, with many sub-tribes, each of which has a dialect of its territory's language, customs, laws, and culture. Still, their general appearance showed the same characteristics and is easily identified (Grimes 2000). This tribe shares physical features, architecture, language, oral traditions, customs, social structure, weapons, agricultural technology, and similar views of life (Davis 1993). In addition, they have a genuine belief in Kaharingan (animism), although many are

now an official religious follower (Kana 2004; Winzeler 2008).

Ethnicity and diversity the Dayak community of Central Kalimantan has a relatively different ethnicity than West Kalimantan and other regions. The majority of the ethnic groups that inhabit Central Kalimantan are ethnic Dayak Ngaju, Ot Danum, Maanyan, Dusun, etc. While the religion they profess is very varied. The Dayak, who are Muslim in Central Kalimantan, still maintain their ethnicity as a Dayak and the Christian Dayak. The original religion of the Dayak Tribe in Central Kalimantan is Kaharingan. This religion was born from the local culture before the Indonesians recognized the first religion, namely Hinduism. Because Hinduism has spread widely in the world, especially Indonesia, and is more widely known when compared to the Dayak religion, the Kaharingan Religion is categorized as a branch of Hinduism (Darmadi 2017).

West Kalimantan Province has its uniqueness to cultural acculturation or the transfer of religious culture for the local community. In this case, the process is closely related to the three largest tribes in West Kalimantan, namely the Chinese (Tionghoa), Dayaks (Dayak), and Malays (Melayu) (TIDAYU). There is TIDAYU batik and TIDAYU dance tunes. At first, the Dayak people inhabited the coastal areas of West Kalimantan, living with their respective traditions and culture, then traders from Gujarat who were Muslim (Arab-Malay) came to buy and sell goods from and to the community. The Dayaks, then because of their frequent interactions, go back and forth to pick up and deliver merchandise from and to the Malacca Strait (which was a trading center in the past), causing them to want to settle in a new area that has excellent trade potential for profit (Darmadi 2017).

Most Dayak Tribe who embrace Islam no longer recognize themselves as Dayaks but refer to themselves as "Malays" or "Banjarese" people. Meanwhile, the Dayaks who did not embrace Islam returned to the river, entering the interior of Kalimantan. In South Kalimantan, for example, they live around the areas of Kayu Tangi, Amuntai, Margasari, Watang Amandit, Labuan Lawas and Watang Balangan. Others continue to enter the jungle. The Dayak people who embrace Islam are mostly in South Kalimantan and parts of Kotawaringin, one of the famous Sultans of the Banjar Sultanate is Lambung Mangkurat, a Dayak Maanyan or Ot Danum. His name is immortalized as the name of Lambung Mangkurat University in Banjarmasin (Fridolin Ukur 1971).

Each Dayak cultivates and develops their own culture in daily life. For example, there is a growing trend in dance or other arts apparel that is based on location. Saber is considered magical in the art of old weaponry and is exclusively used in select rituals such as combat, headhunting, fixtures, traditional dance, and ceremonial. Saber is thought to have effective or miraculous properties. The power of magic is drawn not just from manufacturing rituals, but also from the headhunting tradition. The more people who will be more powerful dikayau mandanya. The results of the hair kayau were utilized to embellish the handle of the "Saber." They think that individuals who die

in-kayau, his spirit, will reincarnate as a magical Saber in their mandau. However, the function of the Saber has changed significantly over time, including as objects of art and culture, souvenirs, collectibles, and weapons for hunting, pruning shrubs, and farming, though it still be recognized Dayak in the forest and in the mountains that preserve the ritual as sacred goods (Darmadi 2017).

THE ETHNOBOTANY OF MEDICINAL PLANTS USED BY DAYAK TRIBE

Ethnobotany is defined as the relationship between humans and plants, which is developed through traditional culture and ways of life on how plants provide value for humans (Erinosa and Aworinde 2012; Ningthoujam et al. 2014; Parvaiz 2014; Kusuma et al. 2015; Sunariyati 2018; Yeung et al. 2020). Traditional tribal communities in Indonesia widely apply ethnobotany because it results from interactions, processes, and attitudes between indigenous peoples and the use of plants in the forest.

In forested regions such as in the tropics, local communities or indigenous peoples have a strong connection and play an essential role in forest management using the ethnobotanical knowledge and practice they always do (Mary et al. 2012; Ningthoujam et al. 2012; Balilla et al. 2013; Thakar et al. 2015; Alzina 2017; Andrade et al. 2017). If there are changes to forest areas, it will affect the loss of traditional knowledge, and forest resources are no longer sustainable (Pieroni et al. 2014). The application of ethnobotany itself is one of the indicators used for sustainable use of natural resources (Nahdi et al. 2016). In the forest-based community, the decline in ethnobotany knowledge indicates forest degradation because the role of local communities in managing forest resources has decreased.

As part of ethnobotanical knowledge possessed by indigenous peoples, the traditional use of plants has developed and has been hereditary. One of the uses of plants by indigenous people is for medicinal purposes. It is easy for them to get plants with medicinal properties, which can be planted around the house and processed by themselves. In broader society, the documentation of the use of medicinal plants through ethnobotanical studies enables drug development and plant conservation (Calzada and Bautista 2020).

The Indonesian population has long used plants as medicines. The use of plants for medicine is also varied according to the ethnic diversity they have. One of the ethnic groups in Indonesia that extensively and traditionally uses medicinal plants as a traditional medicine in treating health problems is the Dayak Tribe in Kalimantan. Dayak Tribe has been using plants in the treatment of various diseases since ancient times. The Dayak Tribe uses medicinal plants that exist in their nature in various ways and purposes (Luardini et al. 2019, Yusro et al. 2020b). The means and objectives in this utilization are very concerned about environmental sustainability and the preservation of medicinal plants themselves. This utilization is also one of the cultural heritage and customs

of their tribe so that the Dayak Tribe still maintains it today. Knowledge about traditional medicine by utilizing medicinal plants around them has been obtained from generation to generation from the ancestors since ancient times (Pieroni et al. 2015). The traditional use of medicinal plants has many advantages for the Dayak Tribe because it is easy to obtain and process them, the Dayak Tribe also do not need to pay a lot of money when compared to modern medicines, and besides that, the use of these medicinal plants has no side effects when compared to modern medicine (Dias et al. 2012; Bahmani et al. 2014; Karimi et al. 2015; Sari et al. 2015).

Typical uses of medicinal plants by Dayak Tribe are for daily health complaints, such as fever, skin diseases (Oon et al. 2015; Rajput et al. 2014), flu, mouth sores, digestive diseases, external wounds, coughs, colds, toothaches, and other frequently encountered diseases (Abdelgadir and van Staden 2013). However, some plants can also be used to treat more severe disease conditions such as diabetes, cancer, hypertension, malaria, antidote, antimicrobial, diuretic, antibacterial, diarrhea, and anti-inflammatory. It also becomes the basis for researchers to explore further bioactive compounds which have a significant role in disease healing (Choudhury et al. 2011; Shah et al. 2011; Alnajjar et al. 2012; Dey and Rahman 2013; Ruslin et al. 2013; Seyed et al. 2014; Junejo et al. 2015; Kong et al. 2015; Lenta et al. 2015; Sangrueng et al. 2015; Tangjitman et al. 2015; Abdullah et al. 2016; Kalt and Cock 2016; Keshava et al. 2016; Zarate-manicad 2016; Aznam and Atun 2017; Carag and Buot 2017; Gunadi et al. 2017; Rauf et al. 2017; Salleh and Ahmad 2017; Napagoda et al. 2018; Muhammad et al. 2020; Ratnadewi et al. 2020).

The processing of medicinal plants by the Dayak Tribe is generally done in a relatively simple and very traditional way. In the form of processing, the methods used are somewhat similar to the habits practiced by their ancestors, such as boiling, pounding, roasting, mixing in cooking, or they can also be used directly (Jadid et al. 2020). Among such methods, boiling is the most commonly used preparation method of medicinal plants by Dayak Tribe. They believe that the boiling method applied to medicinal plants will release more chemical substances than other methods. The boiling process on medicinal plants can secrete lots of natural compounds in plants compared to different ways. This is because the higher the temperature used to process a substance, the greater the substance's solubility (Sari et al. 2015). Other researchers have found similar findings, with boiling being the most prevalent way of preparation (Mussarat et al. 2014; Ahmed 2016; Jadid et al. 2017; Shaheen et al. 2017; Malik et al. 2018; Taibi et al. 2020). Simple, easy handling, and inexpensive are the significant reasons why this mode of preparation is widely used by society (El Amri et al. 2015). Moreover, other reports also demonstrated that boiling might increase the efficiency of plant extraction and therefore increase its bioactivity (Barkaoui et al. 2017).

Plant parts commonly used include the roots, stems, fruit, leaves, seeds, flowers, rhizomes, tubers, and others (Putri et al. 2016; Riadi et al. 2019). Leaves are the part most commonly used as a medicinal ingredient, while the

minor part is the flower (Bradacs et al. 2011; Leto et al. 2013; Mesfin et al. 2013; Nedelcheva 2013; Samoisy and Mahomodally 2015; Umair et al. 2017; Jadid et al. 2020; Kadir et al. 2015). According to research by Maryadi et al. (2012), the selection of leaves as the material for processing traditional medicinal is that the leaves are considered not to disturb the life of medicinal plants so that the plant's existence can be sustainable. In addition, leaves are very easy to process, have a lot of chemical content, and the texture of the leaves is soft (Rehman et al. 2015; Sauini et al. 2020). Therefore, the use of leaves as medicinal ingredients does not significantly impact the growth of a species and does not damage plant survival. Moreover, many reports have shown that leaves contain diverse plant secondary metabolites (Zahoor et al. 2017; Ullah et al. 2020). This is in line with the principles of the Dayak Tribe in the sustainable use of nature.

There are seven ways of using plants as traditional medicine by the Dayak Tribe: drinking, sticking, eating, smearing, soaking, bathing, and compressing. Among such modes, drinking is the most commonly practiced by the Dayak Tribe (Norvalia et al. 2018). This is because the Dayak Tribe believes that the use of drugs by drinking will react more quickly to cure diseases than by other modes, such as being rubbed, eaten, compressed, bathed, soaked, and pasted (Khairiyah et al. 2016).

DAYAK SUB-TRIBE UTILIZATION OF MEDICINAL PLANTS

The utilization of medicinal forest plants has been done by various ethnic Dayak Tribe in Borneo for generations, such as Dayak Paramasan (Anshari et al. 2015), Dayak Ngaju (Kuswanto 2017; Maimunah et al. 2020), Dayak Tunjung (Setyowati 2011), Dayak Iban (Supiandi and Leliavia 2020), Dayak Kanayatn (Sari et al. 2021), Dayak Karo', Dayak Bukat (Yusro et al. 2014), and other Dayak ethnic in Borneo. Each community group or tribe certainly has its knowledge and ways of using plants as medicinal ingredients.

The use of various species of medicinal plants used by the Dayak Tribe has differences in terms of the part of the plant taken, how to process it, how to use it, and its use in each region or the Dayak Sub-tribe that uses it. This is because each Dayak Sub-tribe or region has its role model for using these medicinal plants. For example, for a similar ailment, the leaves of a plant species are used in one area by a Dayak sub-tribe, but it could be that the plant roots are used in other areas. Considering that almost all Dayak sub-tribes are familiar with the use of medicinal plants to treat various diseases, this paper selects six sub-tribes as examples, namely: Desa Dayak Sub-tribe (member of Iban Dayak), Jangkang Dayak Sub-tribe (member of Klemantan Dayak), Bakumpai Dayak Sub-tribe (member of OtDanum-Ngaju Dayak), Kenyah Dayak Sub-tribe (member of Apokayan Dayak), Tagol Dayak Sub-tribe (member of Murut Dayak), and Siang Dayak Sub-tribe (member of Punan Dayak).

Desa Dayak

The Desa Dayak Sub-tribe (member of Iban Dayak) lives in Pakak Village, Sintang District, West Kalimantan use at least 25 species plants from 9 families as traditional medicinal ingredients (Table 1). Medicinal plants are utilized as the first line of defense against sickness. The plants, whether grown or wild, are harvested directly from the forest or the backyard. The Araceae family dominates the medicinal plants used by the Desa Dayak community, with the leaves being the most extensively used component of the plants. The highest value was observed in *Colocasia esculenta* (Keladi). By the Desa Dayak community, all parts of the Keladi are boiled and then eaten to treat high blood pressure. In addition, Dayak Desa people invest specific philosophical meanings in using plants as traditional medicines. The plants that have philosophical implications include: *Anisophyllea disticha* (Kayu Ribu), which is believed to have a thousand benefits, such as fatty liver, *Dracaena marginata* (Telusuh Punan), which is supposed to provide protection when a mother gives birth, *Cheilocostus speciosus* (Pentawar), which has the meaning of being conditioning because the plants are cold, *Alstonia scholaris* (Pelaik), which is said to be able to mend organs harmed by falls, *Merremia peltata* (Akar Jelayan) and *Cordyline fruticosa* (Sabang Balek), which is thought to repel or be an antidote to poison (Supiandi et al. 2019a).

Jangkang Dayak

The Jangkang Dayak Sub-tribe (member of Klemantan Dayak) uses at least 38 families of 65 plant species for traditional medicinal ingredients (Table 1). Euphorbiaceae, Liliaceae, and Zingiberaceae are the most commonly used families (Sari et al. 2015). The emergence of dominant plant species and families are linked to favorable environmental and climate conditions (Farooq et al. 2019; Qaseem et al. 2019). In the Euphorbiaceae family, several plants are used as medicinal plants, including: *Pedilanthus tithymaloides* (Penawar Lipan) which the community uses to treat venomous animal bites, *Jatropha multifida* (Betadine Hutan), which almost all parts of the plant (roots, leaves, sap, and seeds) can be used to treat various kinds of complaints such as coughs, tooth decay, and also treat wounds. *Acalypha wilkesiana*, which the leaves are used to treat headaches, and *Hevea brasiliensis*, which the surrounding community can use the sap as a nutritional medicine to treat venomous animal bites, such as snakes. In the Liliaceae family, *Eleutherina americana* (Bawang Hutan) can be used by the community to treat high blood pressure or hypertension, *Allium cepa* (Bawang Merah) can be used as a medicine to treat various diseases ranging from headaches, flatulence, and fever. In addition, there is also *Allium sativum* (Bawang Putih) used to treat toothaches and skin diseases, such as tinea versicolor, and *Dianella ensifolia* (Siak-Siak) to treat pain when urinating. In Zingiberaceae family, *Zingiber officinale* (Liak) is used to medicine after childbirth, sprains, rheumatism. While *Kaempferia galanga* (Kencur) for relieving fatigue. Sharifi-Rad et al. (2017) described that plants from the Zingiberaceae family are a potential

source of bioactive phytochemicals. Zingiberaceae is the most widely used family in Asia, especially in the tropical region (Kumar et al. 2013).

Bakumpai Dayak

In the Bakumpai Dayak Sub-tribe (member of OtDanum-Ngaju Dayak), at least 10 plants are very common to be used for treating various diseases (Table 1) (Reynaldi et al. 2019). Their use has been carried out from generation to generation since ancient times by their ancestors (Panjaitan et al. 2021). Medicinal plants include *Caulerpa racemosa* (Alga Hijau), often found in lakes and utilized in all the parts by mashed and dried and used as a powder for treating various skin diseases such as leprosy, ringworm, and measles. Then *Senna alata* (Ketepeng China) is utilized its roots by boiling them and use them similarly with the same function as the green algae. *Senna alata* is reported to have antimicrobial properties (Jayachitra et al. 2018) and is antidiabetic (Kazeem et al. 2015). Besides, the leaves and roots of *S. alata* are also proven to be antioxidants (Abubakar et al. 2015). *Morinda citrifolia* (Noni) can also be utilized in its origins to treat high blood pressure. *Albizia saponaria* (Langir) is often found in forests, and its roots are nutritious for treating hair by smoothing it and mixing it with water to wash it on the hair. *Calameae calamus* (Rotan) is utilized by burning, and the ashes are applied to maintain dental health. Studies carried out on the *Musa acuminata* (Pisang) show that its flowers are reported to have anticancer properties (Timsina and Nadumane 2014), and its leaves can be used to treat wounds (Putra et al. 2017). Furthermore, various research results summarize that banana plant can be used as a diuretic, analgesic, wound healing, antioxidant, allergy, antibacterial, antihypertensive (Lakshmi et al. 2015), and *Bambusa vulgaris* (Bambu Kuning), whose stems are boiled to treat jaundice. Fitri et al. (2020) stated that *B. vulgaris* extract contains compounds that have the potential as an analgesic, antipyretic, antidiabetic, anti-inflammatory, antimicrobial, antioxidant, antiviral, hepatoprotective, and diuretic, *Cananga odorata* (Kenanga) is also used its bark by boiling it to treat malaria and asthma, and *Dillenia excelsa* (Simpur) is used its bark to cure wounds. *Achillea millefolium* (Daun Seribu), which the Bakumpai Dayak Tribe uses by boiling it. Based on the use of medicinal plants as ingredients for traditional medicinal roots are part of the medicinal plants most widely used by the Bakumpai Dayak Tribe (Reynaldi et al. 2019).

Kenyah Dayak

The Kenyah Dayak Sub-tribe that lives in Umaq Bekuai Village, Tabang, Kutai Kartanegara, Kalimantan (member of Apokayan Dayak) uses at least 18 families of 26 species plants used as traditional medicine (Table 1). There are three families with the most dominant uses, namely Acanthaceae, Compositae, and Euphorbiaceae. The processing of medicinal plants in the Kenyah Dayak

community is by boiling, pounding, drinking, and making Pupur (glued or rubbed on the sick part). In the Acanthaceae family, there are *Graptophyllum pictum* (Kemba), and *Justicia gendarussa* (Kembat), which are used to treat itchiness in infants, *Hemigraphis bicolor* (Tumbuh Daging) leaves are used as bloody stools. In the Compositae family, there is *Vernonia amygdalina* (Udo Lepek) which can treat diabetes by drinking boiled water from its leaves, *Ageratum conyzoides* (Tambora) which can treat blood laxative disease (menstruation) in women, *Tagetes erecta* (Bunga Saret Batak) can treat a cough with phlegm by drinking boiled water from its roots. Finally, in Euphorbiaceae, the plant *Excoecaria cochinchinensis* (Serat Merah) can treat rheumatic diseases by drinking boiled water from its leaves, and *Euphorbia tithymalooides* (Patah Tulang) can treat fractures (Sagala et al. 2020).

Tagol Dayak

The Tagol Dayak Sub-tribe (member of Murut Dayak) living in Tau Lumbis Village, Nunukan Regency, North Kalimantan Province, frequently uses 12 species of plants as traditional medicine. These plants are: *Nauclea orientalis* (Tembalu), whose bark is used as a medicine for blood vomits, *Arcangelisia flava* (Bala'an), which is used for stomachaches, *Clibadium surinamense* (Turiaris), which is used as a wound medicine, *Crotalaria spectabilis* (Balilang) which is used as a medicine as a cure for ringworm, the sap from the plant *Schismatoglottis calyptata* (Natu) is used to treat the external wound, the leaves of the *Stachytarpheta jamaicensis* (Kalam) to treat toothache, *Cinnamomum iners* (Lawang) which its bark is used to the prevention of flu, indigestion, and flatulence control. *Shorea* spp. (Kawang) which is used as a traditional oil to treat aches (Royyani and Efendy 2015).

Siang Dayak

The Siang Dayak Sub-tribe who lives in the Uut Murung Subdistrict, Murung Raya District, Central Kalimantan (member of Punan Dayak) uses 104 medicinal plant species from 98 genera and 58 families. Most of the families were Rubiaceae (11 species), Fabaceae (9 species), Euphorbiaceae (7species), Moraceae (6 species), Zingiberaceae (4 species), Acanthaceae, Apocynaceae, Thelypteridaceae, Rutaceae, Phyllanthaceae (3 species) respectively, and other families were one species. Only a few complete species of functional organ parts with their medicinal functions (Table 1). Only 4 species of rare Indonesian medicinal plants have been identified (Rifai et al. 1992). These include tabat Barito (*Ficus deltoidea*), bajakahendak (*Arcangelisia flava*), jelutung (*Alstonia scholaris*), and tikangsiu (*Eurycoma longifolia*). Many traditional markets in Kalimantan sell medicinal plants utilized by the native Dayak Tribe, such as *Arcangelisia flava*, *Eurycoma longifolia*, *Alstonia scholaris*, *Luvunga sarmentosa*, and *Psychotria leptothyrsa* roots.

Table 1. Medicinal plants species that used by Dayak Tribe in: Desa Dayak Sub-tribe (member of Iban Dayak), Jangkang Dayak Sub-tribe (member of Klemantan Dayak), Bakumpai Dayak Sub-tribe (member of OtDanum-Ngaju Dayak), Kenyah Dayak Sub-tribe (member of Apokayan Dayak), Tagol Dayak Sub-tribe (member of Murut Dayak), and Siang Dayak Sub-tribe (member of Punan Dayak)

Family	Scientific name	Local name	Part	Utilization medicine
Acanthaceae	<i>Graptophyllum pictum</i>	Kemba	Leaf	For bathing babies and itching ^d
	<i>Hemigraphis bicolor</i>	Tumbuh Daging ^d , Bemulom ^f	Leaf	Bloody stools ^d , blood booster ^f
	<i>Hemigraphis</i> sp.	Sugi Gajah	Leaf	Internal infection ^d
	<i>Justicia gendarussa</i>	Kembat ^d , Kumat Sirang ^f	Leaf	(For bathing babies and itching) ^d , (rheumatism, thrush, fevers, cough, dysuria, diarrhea, jaundice and as antivenin) ^f
Acoraceae	<i>Acorus calamus</i>	Jerangau	Rhizome, stem	A cough ^a
Agavaceae	<i>Parthenocissus quinquefolia</i>	Sabang	Shoot	Pain in the ribs area ^a
Amaranthaceae	<i>Amaranthus spinosus</i>	Bayam Duri	Root, Stem, leaf	Treating dry eyes, eczema, ulcers, fever ^b
	<i>Amaranthus tricolor</i>	Bayam Merah	Leaf	Wounds venomous animal bites ^d
Amaryllidaceae	<i>Crinum asiaticum</i>	Bakung	Tuber	Orchitis ^a
	<i>Crinum</i> sp.	Bakung	Leaf	Fracture ^d
Anisophylleaceae	<i>Anisophyllea disticha</i>	Kayu Ribu	Root	Fatty liver ^a
Annonaceae	<i>Annona muricata</i>	Nangka Belanda	Leaf	(High blood pressure, gouta) ^f , (treating back pain, rheumatism) ^b
	<i>Cananga odorata</i>	Kenanga	(Roots, leaf) ^a , Bark ^c	Used for battle ^a , (malaria, asthma) ^c
	<i>Goniothalamus macrophyllus</i>	Sopung	Root	After giving birth ^f
Apiaceae	<i>Apium graveolens</i>	Seledri	Roots, stem	Treating dry eye, rheumatism ^b
Apocynaceae	<i>Alstonia scholaris</i>	Pelaik ^a , Pulaui ^b , Jelutung ^f	Sap ^b , Whole part ^{a,f}	Internal wounds (contusion) from falling ^{a,b} , (malaria fever, abdominal pain, cough, menstrual smoothing, appetite enhancer and diabetes) ^f
	<i>Parameria polyneura</i>	Kayu Rapet	Leaf	Treat vaginal discharge, stop bleeding ^b
Araceae	<i>Acorus calamus</i>	Jeringau	Leaf	Treat nosebleeds ^b
	<i>Arisaema tortuosum</i>	Buruk Sisi	Leaf	A headache ^a
	<i>Colocasia esculenta</i>	Keladi	Whole part	High blood pressure ^a
	<i>Homalomena occulta</i>	Ilung	Whole part	Burnt ^a
	<i>Schismatoglottis calypttrata</i>	Natu	Sap	Cure wounds ^c
Areaceae	<i>Areca catechu</i>	Pinang	Fruit	Ulceration ^a
	<i>Calameae calamus</i>	Rotan	Root	To maintain dental health ^c
	<i>Cocos nucifera</i>	Kelapa	Flower ^a , (Coconut water, roots, Coconut oil) ^b	Maintain breast milk supply ^a , (treating gerumut, fever, diarrhea, toothache, dandruff, exposure to venomous animals, flatulence, headaches, excessive breast milk, shiny hair) ^b
Asparagaceae	<i>Cordyline fruticosa</i>	Sabang Balek	Leaf	An antidote to the poison ^a
	<i>Dracaena marginata</i>	Telusuh Punan	Root	Childbirth ^a
Aspleniaceae	<i>Asplenium nidus</i>	Rajang ^a , Paku Kajang ^b	Shoot ^a , Leaf ^b	Deep wounds, remove dandruff ^b
Asteraceae	<i>Achillea millefolium</i>	Daun Seribu	Leaf	Body care ^c
	<i>Ageratum conyzoides</i>	Kayu Alit	Root, leaf	Wound ^a
	<i>Arcangelisia flava</i>	Bala'an	Bark	Stomach ache ^c
	<i>Clibadium surinamense</i>	Turiaris	-	Cure wounds ^c
	<i>Elephantopus mollis</i>	Sawi Hutan	Leaf, stem	Treat stomach pain, lack of blood, vaginal discharge ^b
	<i>Elephantopus scaber</i>	Sawi Hantu ^a , Daun Pencolap ^b	Leaf	Malaria ^a , (treat headaches, flatulence, fever) ^b
	<i>Eupatorium triplinerve</i>	Uringan	Leaf	Toothache, headache, exposure to venomous animals ^b
Blechnaceae	<i>Stenochlaena palustris</i>	Pakis Miding	Root	Internal wounds and erection problem (man) ^a
Brassicaceae	<i>Cardamine hirsuta</i>	Inai Anan	Leaf, flower	Wash body ^a
Cactaceae	<i>Epiphyllum oxypetalum</i>	-	Leaf	Reduce bleeding ^b

Caesalpinaceae	<i>Cassia alata</i>	Gelombang ^{a,b} , Ketepeng Cina ^c	Leaf ^{a,b} , Root ^c	Ringworm ^a , (tinea versicolor, canker sores, intestinal worms) ^b , (treat leprosy, measles) ^c
Caricaceae	<i>Carica papaya</i>	Pepaya	Leaf	Fever, intestinal worms, toothache and headache ^a
Caulerpaceae	<i>Caulerpa racemosa</i>	Alga Hijau	Whole part	Powder ^c
Clusiaceae	<i>Garcinia mangostana</i>	Manggis	Rind, leaf	Treat headaches, cholesterol, aches ^b
Compositae	<i>Ageratum conyzoides</i>	Tambora	Leaf	Bleeding ^d
	<i>Blumea balsamifera</i>	Mambung	Leaf	Fever ^a
	<i>Tagetes erecta</i>	Bunga Saret Batak	Root	Cough with phlegm ^d
	<i>Vernonia amygdalina</i>	Udo Lepek	Leaf	Treat diabetes ^d
Convolvulaceae	<i>Argyreia nervosa</i>	Ampur	Leaf	Refine the skin ^a
	<i>Merremia aegyptia</i>	-	Leaf	Treating alinia ^b
	<i>Merremia peltata</i>	Akar Jelayan	Shoot	A venomous animal bite ^a
Costaceae	<i>Cheilocostus speciosus</i>	Pentawar	Leaf	Stamina refresher or enhancer ^a
Crassulaceae	<i>Kalanchoe waldheimii</i>	Cocor Bebek	Leaf	Treating ambient ^b
Cyatheaceae	<i>Cyathea mollucana</i>	Paku Rajang	Leaf	Treat boils, cure wounds ^b
Cyperaceae	<i>Cyperus kyllingia</i>	Kaput Burit	Leaf	For vaginal cleaning ^d
Dilleniaceae	<i>Dillenia excelsa</i>	Simpur	Bark	Wound medicine ^c
	<i>Dillenia suffruticosa</i>		Leaf	Smoothing breast milk, wound medicine ^b
Dipterocarpaceae	<i>Shorea</i> spp.	Kawang	Leaf	Traditional oil to treat aches ^e
Euphorbiaceae	<i>Acalypha wilkesiana</i>	-	Leaf	Treat headaches ^b
	<i>Euphorbia hirta</i>	Rumput Patikan Kerbau	Leaf	Treat asthma ^b
	<i>Euphorbia tithymaloides</i>	Patah Tulang	Leaf	For broken bones ^d
	<i>Excoecaria cochinchinensis</i>	Serat Merah	Leaf	Rheumatism ^d
	<i>Hevea brasiliensis</i>	Karet	Sap	Treating venomous animal bites ^b
	<i>Jatropha multifida</i>	Betadin Hutan	Leaf, sap, root, seed	Coughs, tooth decay, and also treat wounds ^b
	<i>Manihot utilissima</i>	Singkong	Leaf, stem, bark	Fever, intestinal worms, diarrhea, rheumatism ^b
	<i>Pedilanthus tithymaloides</i>		Sap	Treating venomous animal bites ^b
	<i>Sauropus androgynus</i>	Cangkok Manis	Leaf	Treating constipation, white tongue, headache ^b
Fabaceae	<i>Albizia saponaria</i>	Langir	Root	For shampooing ^c
	<i>Crotalaria spectabilis</i>	Balilang	Leaf	Ringworm ^e
	<i>Pithecellobium lobatum</i>	Jengkol	Fruit	Treating deficiency of lime ^b
Gesneriaceae	<i>Chrysothemis pulchella</i>		Leaf	Treating alinia ^b
Guttiferaeae	<i>Garania celebica</i>	Asam Kandis	Leaf, fruit, root	Treating acne, earache ^b
Hypoxidaceae	<i>Molineria latifolia</i>		Leaf	Treating alinia ^b
Iridaceae	<i>Eleutherine bulbosa</i>	Udo Lembak	Root	Tonsils ^d
Lamiaceae	<i>Callicarpa longifolia</i>	Sangkareho	Leaf	Stomach pain ^f
	<i>Ocimum basilicum</i>	Kemangi	Leaf, stem	Treating dry eye pain, overcoming flatulence ^b
Lauraceae	<i>Orthosiphon aristatus</i>	Kumis Kucing	Leaf	Stomach ache ^d , facilitate urination ^b
	<i>Cinnamomum iners</i>	Lawang	Bark	Prevention of flu, indigestion, and Flatulence control ^e
Liliaceae	<i>Allium cepa</i>	Bawang Merah	Tuber	Headache, flatulence, fever ^b
	<i>Allium sativum</i>	Bawang Putih	Tuber	Toothache, tinea versicolor ^b
	<i>Dianella ensifolia</i>	Rumput Siak-Siak	Root	Pain when urinating ^b
	<i>Eleutherina americana</i>	Bawang Hutan	Tuber	High blood pressure ^b
Lythraceae	<i>Lawsonia inermis</i>	Pacar	Leaf	For wounds / swelling ^d
Magnoliaceae	<i>Magnolia elegans</i>		Leaf	Treating alinia ^b
Malvaceae	<i>Durio zibhetinus</i>	Durian	Rind	Treat boils ^b
	<i>Hibiscus rosa-sinensis</i>	Kembang Sepatu	Leaf	Gonorrhea ^d
Melastomaceae	<i>Melastoma malabathricum</i>	Kemunting	Leaf, root	Treat wounds ^b
Menispermaceae	<i>Arcangelisia flava</i>	Bajakahendak	Stem	Jaundice, diarrhea, malaria ^f
	<i>Fibraurea tinctoria</i>	Akar Kuning	Root	Malaria ^b
	<i>Pycnarrhena cauliflora</i>	Bekai ^{a, f}	Leaf	Cancer ^{d, f}
Mimosaceae	<i>Mimosa pudica</i>	Putri Malu	Root	Treating breast cancer ^b
Moraceae	<i>Artocarpus heterophyllus</i>	Nangka	Leaf	Speeds up the release of the baby's umbilical cord ^b
	<i>Ficus deltoidea</i>	Tabat Barito	Leaf	After giving birth ^f
	<i>Ficus racemosa</i>	Ara	Leaf, fruit	Launching breast milk, warts ^b
Musaceae	<i>Musa acuminata</i>	Pisang	Stem	Antidote ^c
Myrsinaceae	<i>Labisia pumila</i>	Cula Adam	Leaf	Process of giving birth ^f

Myrtaceae	<i>Psidium guajava</i>	Jambu	Leaf	Diarrhea ^d
	<i>Syzygium polyanthum</i>	Bungkang	Leaf	Heartburn, lower blood, diabetes, high blood ^b
Nephrolepidaceae	<i>Syzygium cumini</i>		Leaf, bark	Treating canker sores ^b
Oleaceae	<i>Nephrolepis cordifolia</i>	Julut	Root	Vaginal health ^d
	<i>Jasminum sambac</i>		Leaf, flower	Treating red eye pain, exposure to venomous animals, fever, headache, shortness of breath/asthma ^b
Orchidaceae	<i>Olea dioica</i>	Nuris	Leaf	Treating internal wounds ^b
Phyllanthaceae	<i>Acriopsis liliifolia</i>	Bawang Kayu	Rhizome	Bleeding ^d
Piperaceae	<i>Phyllanthus niruri</i>	Nyiur Hongo	Leaf, Root	Scabies and wounds ^d
	<i>Piper betle</i>	Sirih	Leaf	Sore throat ^d , reduce excess breast milk ^b
	<i>Piper crocatum</i>	Sirih Merah	Leaf	Diabetes, ulcer ^b
	<i>Piper nigrum</i>	Lada	Leaf	Fever ^b
Poaceae	<i>Bambusa vulgaris</i>	Bambu Kuning	Stem	Treating jaundice ^c
	<i>Cymbopogon citrates</i>	Serai	Leaf, root	Streamlining menstruation ^b
	<i>Imperata cylindrica</i>	Alang-Alang	Root	For bone pain ^d
	<i>Oryza sativa</i>	Padi	Fruit, rind	Eliminate fatigue, shiny hair ^b
	<i>Panicum sp.</i>	Rumput Jalar	Leaf	For back pain ^d
Polypodiaceae	<i>Pyrosia piloselloides</i>	Letek	Leaf	Tumor ^d
Rubiaceae	<i>Morinda citrifolia</i>	Kudu	Leaf ^b , fruit ^b , Root ^c	(Jaundice, influenza) ^b , treating high blood pressure ^c
	<i>Myrmecodia beccarii</i>	Sarang Semut	Nest	Tumors, tbc asthma, hemorrhoids, and postpartum women ^f
	<i>Myrmecodia tuberosa</i>	Sarang Semut	Tuber	Treat aches ^b
	<i>Nauclea orientalis</i>	Pengilara Larimbata	Leaf	Anti-leech ^e
	<i>Nauclea sp.</i>	Tembalu Luwohon	Bark	Medicine for vomiting blood ^e
	<i>Psychotria leptothyrsa</i>	Ginseng	Root	Increase stamina ^f
Rutaceae	<i>Citrus aurantifolia</i>	Jeruk Nipis	Fruit	Shiny hair, tonsils ^b
	<i>Luvunga sarmentosa</i>	Saluang Balum	Root	Increase stamina ^f
Simaroubaceae	<i>Eurycoma longifolia</i>	Lingkau ^e , Tikangsiu ^f	Root	Aphrodisiac ^e , after giving birth ^f
Solaneceae	<i>Capsicum anum</i>	Cabe	Seed	Relieve fatigue ^b
	<i>Physalis angulata</i>	Lolotup	Leaf, root, stem, flower	Treating lung disease, influenza ^b
	<i>Solanum torvum</i>	Terong Pipit	Root, fruit	Myopic eyes, swelling due to being hit ^b
Thymelaeaceae	<i>Phaleria macrocarpa</i>	Mahkota Dewa	Leaf, fruit	Treat itching, diabetes ^b
Tiliaceae	<i>Pentace sp.</i>	Kaya Rianggas	Leaf	Cough ^e
Verbenaceae	<i>Stachytarpheta jamaicensis</i>	Kalam	Leaf	Toothache medicine ^e
	<i>Vitex pinnata</i>	Roban	Leaf	Stomachache, headache ^b
Zingiberaceae	<i>Alpinia galanga</i>	Lengkuas	Rhizome	Medicine after childbirth, backache, fever ^b
	<i>Curcuma domestica</i>	Kunyit	Rhizome	Overcoming tonsils, after giving birth ^b
	<i>Kaempferia galanga</i>	Kencur	Leaf, rhizome	Relieving fatigue ^b
	<i>Zingiber officinale</i>	Leak	Rhizome	Medicine after childbirth, sprains, rheumatism ^b

Note: a: Desa Dayak Sub-tribe (member of Iban Dayak) (Supiandi et al. 2019a), b: Jangkang Dayak Sub-tribe (member of Klemantan Dayak) (Sari et al. 2015), c: Bakumpai Dayak Sub-tribe (member of OtDanum-Ngaju Dayak) (Reynaldi et al. 2019), d: Kenyah Dayak Sub-tribe (member of Apokayan Dayak) (Sagala et al. 2020), e: Tagol Dayak Sub-tribe (member of Murut Dayak) (Royyani and Efendy 2015), and f: Siang Dayak Sub-tribe (member of Punan Dayak) (Wardah and Sundari 2019)

To promote stamina, *Eurycoma longifolia* (Tikangsiu), *Psychotria leptothyrsa* (Ginseng), and *Ficus deltoidea* (Tabat Barito) are utilized, especially for males, and usually after childbirth for women, *Arcangelisia flava* (Bajakahendak) and *Alstonia scholaris* (Jelutung) is empirically used by the Dayak people to treat malaria, *Luvunga sarmentosa* (Saluang Balum) which its roots are boiled and drink to increase stamina, aphrodisiac, and male fertility, *Labisia pumila* (Cula Adam) is better known for its role in medicine related to the postpartum

process, *Myrmecodia beccarii* (Sarang Semut) is one species of medicinal plant that is widely used to treat TBC and asthma, *Goniothalamus macrophyllus* (Sopung) is used for fever, the leaves of *Callicarpa longifolia* (Sangkareho) is helpful to treat stomach pain and the leaves of *Pycnarrhena cauliflora* (Sokai) which is used as a substitute for cooking spices to replace synthetic chemicals in modern flavoring cuisine which can interfere human health (Wardah and Sundari 2019).

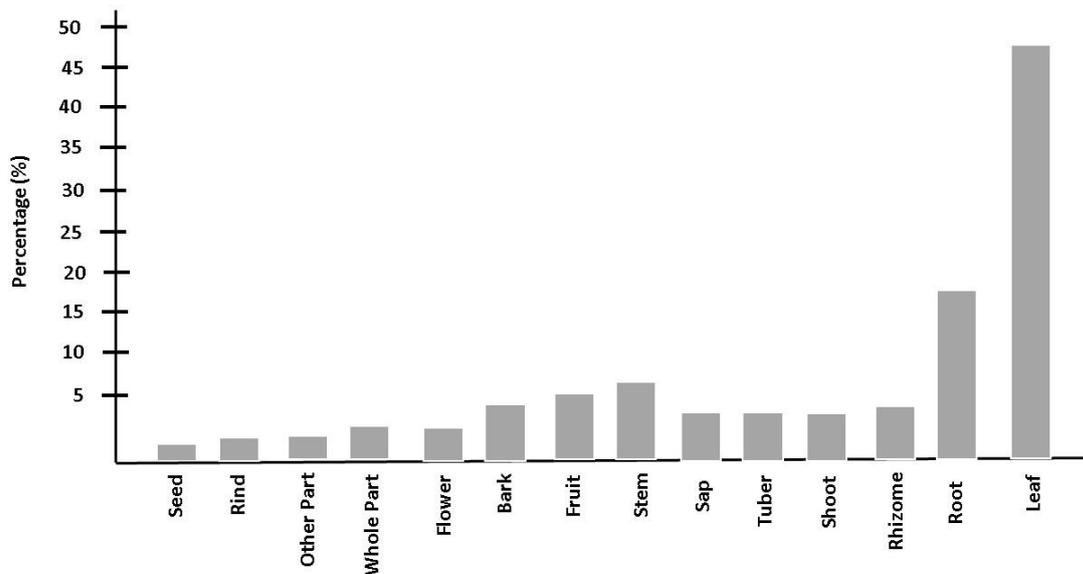


Figure 2. Parts of plants used as medicine by Dayaks

The results from 6 Dayak Sub-tribe revealed 63 families of plants from which 133 species came (Table 1). The family most widely used for medicinal plants, namely Euphorbiaceae, consists of 9 species. Plants of the Euphorbiaceae family are easy to grow so they are found in various habitats. Plants generally consist of roots, stems, leaves, flowers, fruits, and seeds. The results (Table 1) showed that most of the people in the community usually use the leaf (47%), root (18%), stems (6%), fruits (5.4%), bark (4.2%), rhizomes (3.6%), Sap (3%), Tuber (3%), Shoot (3%), whole part (2.4%), flowers (2.4%), other parts: coconut water, coconut oil, nest (1.8%), rind (1.8%), and seed (1.2%) (Figure 2). Dayak Tribe believes that they will not kill the plants if they only use the leaves because they will grow back and be used continuously. On the other hand, it will be dangerous if they use different parts of the plants such as stems, roots, rhizomes, tubers, and bark as medicine because it can kill these plants if used continuously.

In terms of management, the Dayak Tribe has not specifically managed medicinal plants. Most of the medicinal plants used by the Dayak Tribe are wild plants that grow around residential areas (Aryadi et al. 2014). However, in some cases, medicinal plants are cultivated because of their difficulty in finding them in the forest (Palupi 2013). Plant cultivation will ease the medication processes because the plants used as medicine are located nearby, and easy to take, so faster handling will be carried out (Yusro et al. 2020a). The management or conservation of medicinal plants can also be carried out with pharmaceutical technology, encouraging efforts to utilize forest resources, especially medicinal plants. By knowing the benefits of medicinal plants, people will want to conserve these medicinal plants to be used in the future.

LOCAL WISDOM OF THE DAYAK TRIBE ON THE USE OF MEDICINAL PLANTS

Local wisdom is behavior that is related to a positive relationship between humans and nature and the environment around them. Local wisdom is known as a view of life, knowledge, and life strategies by local people to answer their problems in their daily needs. The local wisdom of the community is usually passed down from generation to generation (Tamalene et al. 2016; Supiandi et al. 2019a,b). Local wisdom is found by certain local communities who have tried and integrated it with local culture and natural conditions. In a balanced life relationship with nature, local wisdom is basic knowledge obtained by humans (Mungmachon 2012; Pornpimon et al. 2014; Widisono 2019; Dewi et al. 2020). Local wisdom is also interpreted as a tool to preserve the environment, such as in the Dayak Tribe related to environmental management in agricultural or plantation land. With local wisdom, the rate of environmental damage can be contained, and the environment is well preserved (Humaida et al. 2018). However, if the local wisdom began to decrease, one may be caused by a lack of public awareness of the importance of intellectual property assets (Setyowati 2011).

The use of plants as traditional medicine also continues to exist today due to local wisdom. The medicinal plants in the Dayak Tribe have been passed down from generation to generation. The life of the Dayak Tribe is very dependent on nature and forests. For them, nature has excellent benefits for their lives, not infrequently they often use forest products for traditional medicine, which is beneficial for the health of the Dayak Tribe. The Dayak people also believe that not all diseases can be cured by medical means or synthetic drugs, but they can be cured with traditional medicine. This is because plants with medicinal properties are considered to have no harmful side effects (Safitri et al.

2015). So that the Dayak people get a lot of knowledge about traditional medicine through their ancestors in various ways, such as accompanying them in collecting plants to caring for patients (Molina et al. 2015). Furthermore, traditional leaders provide knowledge about the usage of medicinal plants in the form of instructions when they take medication, as well as ancestral messages through dreams or those that are commonly connected with mystical qualities. The limited facilities and infrastructure they have are also a reason for Dayak Tribe to continue using traditional medicinal plants as an option for first aid or as a last alternative if modern medicine does not produce results (Riadi et al. 2019). In addition, people affected by the economic crisis and local communities prefer to do traditional medicine because modern medicines are relatively more expensive.

Traditional medicine is often said to be one of the nation's wealth in the form of local wisdom. Traditional medicine techniques that have been developed to date are using plants around the community, both in the yard and in the forest, to treat various external and internal diseases. The diversity of medicinal plants in nature can support the availability of ready-to-use traditional medicines (Umair et al. 2019). Their availability must accompany the high utilization of medicinal plants in nature to maintain the continuity of the use of medicinal plants (Rahman 2013). Knowledge of local wisdom from the Dayak Tribe in utilizing plant resources will significantly help preserve biodiversity and domestication of medicinal plants (Kandari et al. 2012; Yusro et al. 2014; Budiman et al. 2018; Mediastari 2020). Suppose medicinal plants are exploited more than they should. In that case, it will undoubtedly have a significant impact on their availability in the forest area, and if it continues, it will cause the extinction of certain species (Jima and Megersa 2018; Sarquis et al. 2019; Susanti and Zuhud 2019). According to Neelo et al. (2015) local communities need to be educated about plant conservation, especially those widely used for various important activities such as medicine. That's where the importance of preserving local wisdom in the Dayak Tribe is so that the use of nature is done wisely and it remains sustainable.

CONCLUDING REMARKS

The original people of Borneo's island are known as Dayak. For their communities, the Dayak Tribe employs natural and forest resources in plants as traditional medicine. Since ancient times, the Dayak Tribe has used plants to heal a variety of ailments. The Dayak Tribe employs medicinal plants found in nature in various methods and for a variety of purposes. This utilization is also one of their communities' cultural heritage and customs so that the Dayak Tribe still maintains it today. The knowledge about traditional medicine by utilizing medicinal plants around them has been obtained from generation to generation from the ancestors since ancient times. The use of various medicinal plants used by the Dayak Tribe has differences in terms of the part of the

plant taken, how to process it, and how to use it. This is because each Sub-tribe or region has its role model on how to use these medicinal plants. No wonder if the leaves are used in one area, it could be that the plant roots are used in other areas. Considering that almost all Dayak Sub-tribes are familiar with the use of medicinal plants to treat various diseases, this paper selects 6 sub-tribes as examples, namely: Desa Dayak Sub-tribe (member of Iban Dayak), Jangkang Dayak Sub-tribe (member of Klemantan Dayak), Bakumpai Dayak Sub-tribe (member of OtDanum-Ngaju Dayak), Kenyah Dayak Sub-tribe (member of Apokayan Dayak), Tagol Dayak Sub-tribe (member of Murut Dayak), and Siang Dayak Sub-tribe (member of Punan Dayak). The results from 6 Dayak sub-tribe revealed 63 families of plants from which 133 species came. The family most widely used for medicinal plants, namely Euphorbiaceae, consists of 9 species, and the leaf is the most commonly used part of the plants (47%). Dayak Tribe believes that they will not kill the plants if they only use the leaves because they will grow back and be used continuously. On the other hand, using components of the plants as medicine, such as stems, roots, rhizomes, tubers, and bark, is risky because it can kill the plants if done repeatedly. Traditional knowledge of the Dayak Tribe in utilizing plant resources will significantly help preserve biodiversity and domestication of medicinal plants. If medicinal plants are exploited more than they should, it will undoubtedly impact their availability in the forest area. If it continues, it will cause the extinction of certain species. By knowing the benefits of medicinal plants, Dayak Tribe will want to conserve these medicinal plants to be used in the future.

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