Ethnobiology of the Pesaguan Dayak Tribe as a Science and Biology Learning Resource

Erwinskyh Erwinskyh 1*, Rufina Due 2

1Universitas Indraprasta PGRI, INDONESIA
2Bimbingan Belajar Prosus Inten, INDONESIA
*Corresponding Author: erwinskyh.unindra@gmail.com

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ABSTRACT

A Pesaguan Dayak community is a group of indigenous people living in the upstream area of the Pesaguan river, Ketapang Regency of West Kalimantan, Indonesia. The community utilizes plants and animals for daily life, a highly dependent on nature. The local utilization has not been known widely, including for traditional medicine, ethnic rituals, and food sources. Loss of natural resources and traditional knowledge so rapidly due to high pressure on the resources and intervention of modern culture and development. This research aimed to determine plants and animals’ potential as medicine, traditional rituals, and food used for the Dayak Pesaguan community and to see a possible use for biology learning material. This study used a qualitative method, describing potential plants and animals, and a quantitative approach of validation test to analyze the possible use for biology learning material. The research found 22 plant species and ten animal species used as medicine. There were 15 plants and seven animal species promising for traditional rituals; ten plant species and twelve animals were used as traditional food. A customary knowledge of plants and animals has potential as medicine, food, traditional rituals, and science learning resources for junior high school as well as senior high school biology learning sources.

Keywords: biology education, science education, ethnobiology, indigenous people, customary knowledge

INTRODUCTION

Indonesia is a country with diverse tribes and cultures, and still existing till today. The Pesaguan Dayak people are the indigenous community who inhabit in the upstream of the Pesaguan Watershed, Ketapang Regency of West Kalimantan, Indonesia. These communities spread over three sub-districts, namely Tumbang Titi District, Lalan Panjang Village of Pemahan Sub-District, and the western of Sungai Melayu Rayak District (Tio, 2021).

The Pesaguan Dayak community still practices local traditions in utilizing plants and animals, and they interact closely with nature. The community performs the Dayak Pesaguan 'Nganjani', an annual customary ceremony of gratitude to God, where plants and animals are used as additional support for the ceremony. Unfortunately, most customary wisdom has not been known, including information on plants and animals used as traditional medicine, rituals, and food sources.

According to Darong et al. (2021), local culture is generated from humans’ interaction with their natural environment. Local cultural values are the foundation and source of community ethics in interacting with nature (Thomas, 2015). The Pasaguan Dayak community carries out daily interaction of the Pasaguan Dayak community with their environment from generation to generation.

However, the availability of wildlife animal and plant species in Tumbang Titi District, Ketapang Regency is decreasing. Many people use plant and animal species for various purposes, and conservation efforts are limited. Modern culture and economic reasons contributed to the loss of natural resources and customary knowledge. Meanwhile, formal education does not support the knowledge, and the information is not well inherited from generation to generation.

Another main cause of species loss is deforestation, including forest fire, which contributes to the loss of genetic resources of endemic plants and animals associated with customary traditions. The opening of oil palm plantations, gold mining, and rubber plantations also disrupted the existence of endemic plant and animal species. Many people switch their jobs to become palm oil workers and mining workers.

The utilization of natural resource biodiversity for medicinal has long been used in Indonesia, especially for
people living in rural areas and communities living around the forests. Due to being very widely used, traditional medicinal need to get more attention and support by using appropriate science and technology in collaboration with universities, including with the community in the villages (Zuhud, 2021).

Indigenous people’s knowledge of plants and animals shows biodiversity richness in West Kalimantan and provides information about Indonesia’s cultural and natural richness. For education purposes, natural biodiversity can strengthen students’ knowledge about nature, one of Indonesia’s sub-topics of biology learning materials for students in grade 10 (Yuniastuti et al., 2021). Many learning materials in the surrounding Pesisungan community village can support students in understanding school subjects.

A learning process is not only a knowledge transfer but also about how student practices in his daily purposes. Learning resources in science should come from the surrounding where the student lives (Wibowo, 2019). Students may easily get knowledge from their surrounding living areas to support their studies in class. This knowledge is generated from older family generations.

The author interviewed three biology teachers living in the study area. According to the teachers, students had never carried out learning activities using local knowledge, including knowledge of plants and animals used by the local community for medicine, food, or traditional rituals. The school learning material is only taken and entirely relies on textbooks providing examples of plants and animals outside of Kalimantan, especially Java and its surroundings.

This study aims to determine the types of plants and animals used for medicine, traditional rituals, and food by the Pesaguan Dayak community, Ketapang Regency, and explore potential use as biology learning materials.

**METHOD**

The research was conducted from June 2021 to February 2022. Data was collected with direct observation of the plants and animals used for medicine, traditional rituals, and food by the Pesaguan Dayak community, Ketapang Regency of West Kalimantan Province, Indonesia. Data observation was carried out at Pengatapan Rayak, Seimelau Rayak, and Usaha Baru villages research sites. This study used 15 respondents from the Dayak customary council, customary leaders, shamans, and traditional community leaders representing the Dayak Tribes (Usaha Baru, Pengatapan, and Sei Melayu), village administrators, Empowerment of Family Prosperity (PKK), and other communities.

This research was developed using data triangulation techniques to enhance validity and in-depth picture of problem with observation, interviews, and documentation. The questionnaire used to conduct surveys, includes specific questions to obtain data on plant or animal species used by community. Interviews were conducted using open-ended questions to explore topics in depth, to understand processes, and to identify potential causes of observed correlations regarding the potential use of plants and animals as medicine, food, and traditional rituals.

The interview result was documented in a table datasheet used for quantitative and qualitative analysis. The quantitative analysis uses statistical validation tests, and the qualitative research uses score tests and additional information from the literature.

Identifying how local wisdom of plants and animals is used for customary rituals, medicine, and food may support school subjects by following its basic competencies of learning science for junior high school (SMP) and biology for senior high school biology (SMA). The data was taken with interview processes using provided questionnaires.

Information was documented and analyzed for the potential of their essential competencies as learning resources for junior high and senior high school. Three science teachers at junior high schools in West Kalimantan province were science teachers of SMPN 01 Sei Melayu and SMPN 2 Pemahan, and biology teachers of SMAN 01 Pemahan were used as data validators.

The collected data were analyzed descriptively following three activity paths: data reduction, data presentation, and data conclusion. Data reduction is carried out with a data selection process using an analysis of the feasibility of local materials used for junior and high school learning resources (Arikunto, 2010; Sudjana, 2012), namely:

1. (1) economic, the distance from the school is very close to learning resources,
2. (2) practical, the learning process is easy to implement,
3. (3) flexible, used for various learning purposes, and
4. (4) conformity with learning objectives, the components of learning resources conform to learning objectives.

This study used a formula to measure the feasibility of traditional knowledge adapted to the criteria for learning resources and converted the scores of the requirements for learning resources into the value of the quality of the feasibility of local materials, where \( X = \sum x_n \), \( X \) is the average value of the criteria for learning resources, \( \sum x \) is the total value of the learning resource criteria, and \( n \) is the number of indicators. The score and scale used for assessing the feasibility of local materials that have potential to be a source of science and biology learning resources are shown in Table 1.

The range for assessing the feasibility of local materials that have potential as a resource of science and biology learning can be seen in Table 2.

| Table 1. The criteria for assessing learning resources using local materials as science and biology learning sources |
|-----------------|-----------------|-----------------|
| **Rating score** | **Value**       | **Description** |
| 4               | Very economical| The distance from the school is very close, 0-2.5 km |
|                 | Very practical | Very easy to implement |
|                 | Very flexible  | More than two appropriate basic competencies |
|                 | Very fit with the purpose | The components of the learning resources are all following the learning objectives |
Table 1 (Continued). The criteria for assessing learning resources using local materials as science and biology learning sources

| Rating score | Value                          | Description                                                                 |
|--------------|-------------------------------|-----------------------------------------------------------------------------|
| 3            | Economical                    | Distance from the nearest school is 2.6-5.0 km                              |
|              | Practical                      | Easy to implement                                                            |
|              | Flexible                       | Consists of two appropriate basic competencies                               |
|              | According to the purpose      | Some of the components of learning resources have conformity with learning objectives |
| 2            | Not economical                 | Distance from the school is 5.1-7.5 km                                       |
|              | Impractical                    | Not easy to implement                                                        |
|              | Inflexible                    | Only consists of one appropriate basic competency                            |
|              | Not according to the purpose   | Small number of components of learning resources have conformity with learning objectives |
| 1            | Very uneconomical              | Distance from the school is very far, 7.6-10 km                             |
|              | Very impractical               | Very difficult to do                                                          |
|              | Very inflexible                | Not following appropriate basic competencies                                 |
|              | Very inappropriate with purpose| Components of learning resources do not have conformity with learning objectives |

Note. Adapted from Arikunto (2010)

Table 2. Range of assessment of the feasibility of local materials as learning resources for science and biology

| Rating range | Description                        |
|--------------|------------------------------------|
| 3.1-4        | Strongly meets the criteria        |
| 2.1-3        | Meets the criteria                 |
| 1.1-2        | Does not meet the criteria         |
| 0-            | Strongly does not meet criteria    |

Note. Adapted from Arikunto (2010)

RESULTS

Based on the study, the Pesaguan Dayak community uses 22 medicinal plant species from 16 families, consisting of Fabaceae and Poaceae of 14% each, Asteraceae and Lamiaceae of 9% each, and other 12 families of 5% (Table 3).

In addition to plants, the Pesaguan Dayak people also use animals as medicine. Based on the observations, ten species

Table 3. Plants used as medicine

| No | Species                              | Part & use                                | Processing method                                                                 |
|----|--------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------|
| 1  | Yellow bamboo *Bambusa vulgaris* (Poaceae) | Roots used to treat jaundice & appendicitis | Cleaned roots are boiled, & water is drunk                                       |
| 2  | Bako/Mentha arvensis L. (Lamiaceae)   | All parts to treat complications          | All plant parts are cleaned & then boiled, & water is drunk                       |
| 3  | Onions/Bawang jongkut *Eleutherine americana* (Iridaceae) | Union bulbs are used to treat jaundice & furuncle | Bulbs are cleaned, burned, crushed, & attached to part of furuncle or can be eaten |
| 4  | Belian/Eusideroxylon zwageri (Lauraceae) | Leaves used to prevent hair loss          | Young leaves or shoots eaten                                                       |
| 5  | Beluntas/Phoea indica (L) (Asteraceae) | All parts of the plant used to treat body odor & fever | All parts are cleaned, cut, & boiled. Steam of boiled water evaporated throughout body |
| 6  | Brotowali *Tinospora crispa* (L) (Menispermiaceae) | Roots used to treat malaria, rheumatism, and lower blood sugar | Bertangas is an activity where a steam bath made of boiled leaves or spices is used to treat fever and overcome body odor |
| 7  | Ganda rusa *Justicia gendarussa* (Acanthaceae) | The leaves used to treat headache         | Roots were cleaned, boiled, & water drunk                                         |
| 8  | Kantong semar/Nepentes *Nepentes mirabilis* (Nepenthaceae) | All parts of the plant are used in pain when giving birth, breast tumors, and headache | Take a few leaves and then heat on coals and stick to the head                     |
| 9  | Paku sarang burung *Aspelinia nius* (Aspleniaceae) | Leaves treat cancer and tumors            | All parts of the plant are cut into pieces, dried, boiled with water, and the water drunk, |
| 10 | Patah kemudi/Gynura segetum (Compositae) | All parts of the plant to treat blood in the urine (hematuria), vomiting blood | All plant parts are cleaned, dried, boiled, and water drunk                       |
| 11 | Patah tulang *Pedilanthus prinigi* (Euphorbiaceae) | The sap of the plant to treat toothache | The sap applied to the aching tooth                                               |
| 12 | Pegagan/Centella asiatica (Apiaceae)   | Leaves overcome senile                   | Young leaves eaten right away                                                     |
| 13 | Red bananas *Musa sp.* (Musaceae)     | The banana trunk used to treat broken bones | The banana trunk burned and wrapped around the wound.                            |
| 14 | Rumput benau (Continental grass) *Eleusina indica* (Poaceace) | The root of the grass believes in helping to win a political case | The grass root recited a spell and stored in the person's body                     |
| 15 | Sapu tunggal/Epipremnum sp. (Araceae) | Root used to eliminate allergies         | Root rubbed all over body while chanting a spell                                  |
| 16 | Secang/Calaspinia sappan L. (Fabaceae) | Roots & stems used to treat internal wounds | Roots cleaned, dried, & boiled, & water drunk                                    |
| 17 | Sembang/Blumea balsamifera (Asteraceae) | Leaves used to treat colds and eye pain  | Leaves boiled, hot water vapor inhaled and rapped all over the body                |
used as medicine, including a Pisces class, namely snakehead fish (Channa striata) and catfish (Claris batractus), reptile class, namely raticulated phyton (Malayopython reticulatus), turtles (Manouria emys), monitor lizards (Varanus salvator), house lizards (Hemidactylus platyurus), and gekkos (Gekko gecko), and mammal class, namely sun bears (Helarctos malayanus), hedgehogs (Hystrix brachyura), and rats (Rattus rattus).

More information about the types of animals used as medicine by the customary community can be seen in Table 4.

Plants are also used to support community rituals, including the event of harvesting season of agricultural products, funeral ceremonies, casting out evil spirits, and bathing newborn babies. There are 15 species of nine plant families used for community, as shown in Table 5.
Table 5 (Continued). Plants used as traditional rituals

| No | Species name                      | Traditional rituals           | Rituals processes                                                                 |
|----|-----------------------------------|-------------------------------|------------------------------------------------------------------------------------|
| 7  | Pakis Merah (red fern)            | Bebekung custom               | Bukung must wear a tekaluk jenjamut (a headband made of red fern).               |
|    | Stenochlaena palustris (Blechnaceae) |                 |                                                                                   |
| 8  | Pisang (bananas)                  | Banana trunk                  | Families who lose their family members will put banana trunks, complete with complimentary like the dead bodies such as banana trunks, rope mats, and a machete handle. |
|    | Musa paradisiaca L. (Musaceae)    | Death ceremonial              |                                                                                   |
| 9  | Enau (sugar palm)                 | Mamatik tambairiring          | The customary chief will hang an ancak, a modified bamboo (like climbing an areca nut tree complete with prizes), then drip the tuak (fermented drink from palm trees) onto the ground while reciting a spell. |
|    | Arenga pinnata (Araceae)          | Nganjan                       |                                                                                   |
| 10 | Kelapa Muda (young coconut fruit) | Manumang head* Nganjan       | Manumang head means to burn the head on the tumang stove. In ancient times, there were 48 human heads burned. But now, it's not a human head anymore, but changed with young coconut fruits. |
|    | Cocos nucifera (Araceae)          | Ceremonial                    |                                                                                   |
| 11 | Umbat kelapa (shoot of coconut tree) | Palalawat submission         | Palalawat is an assistance from the community members to the family who organize manumang (manganan) ceremonial, usually in the form of rice, palm wine, pork, chicken, including umbut of the coconut tree, and other consumption materials. The umbut of the coconut tree is the base of the undeveloped coconut shoot at the top of the coconut tree. |
|    | Cocos nucifera (Araceae)          |                               |                                                                                   |
| 12 | Jarau (bamboo)                    | Cutting jarau                 | Jarau is a tree made of bamboo with decorations and branches with various gifts.  |
|    | Bambusa vulgaris (Poaceae)        |                               |                                                                                   |
| 13 | Daun Juang (fighting leaf)        | Beturun mandi (Customary bath ceremonial) | A customary midwife brings newborn babies to bathe in the river with spears, bracelets, shells, and fighting leaves to ward off evil spirits. |
|    | Cordyline fruticose (Asparagaceae) |                               |                                                                                   |
| 14 | Jahe merah (Red ginger)           |                               | A customary midwife brings the newborn baby to bathe in the river, complete with a spear, bracelet, and shell filled with turmeric and red ginger to eliminate the disease. |
|    | Alpinia purpurata (Zingiberaceae) |                               |                                                                                   |
| 15 | Kanyit (turmeric rhizome)         |                               |                                                                                   |
|    | Curcuma longa (Zingiberaceae)     |                               |                                                                                   |

Table 6. Animals used in customary rituals

| No | Species name                      | Traditional rituals           | Rituals processes                                                                 |
|----|-----------------------------------|-------------------------------|------------------------------------------------------------------------------------|
| 1  | Chicken                           | Menyinah Tihang Sandung      | Tihang Sandung is a tall pillar where the body is buried, covered with chicken blood. While plucking the feathers on the neck of the chicken to be cut, the shaman (batara’) will pray (batatou). The purpose of batatou is to ask for the smoothy of the implementation kanjan serayung ceremony (death ritual), avoiding diseases, fights, and others avoided in its implementation. |
|    | Gallus gallus domesticus (Aves)   |                               |                                                                                   |
| 2  | Turtles/Testudines sp. (Reptilia) | Menyinah Tihang Sandung      | Tihang Sandung will be covered with chicken and turtle blood.                      |
| 3  | Pigs/Sus barbatus (Mammalia)      | Mystical symbol              | Symbol of family bonding, a fending off to evil spirits                           |
|    | Canis lupus (Mammalia)            | Mystical symbol              | The sound of a dog barking is a sign of a spirit, and a dog’s head is used as an offering in traditional ceremonies |
| 4  | Hornbill                          | Mystical symbol              | Bird’s wing and tail feathers are used to decorate hats used in traditional ceremonies worn by Indigenous Peoples (Demong). |
|    | Buceros rhinoceros (Aves)         |                               |                                                                                   |
| 5  | Rhinoceros hornbill               | Mystical symbol              | The Dayak people believe that the hornbill is a sacred bird. Therefore, the hornbill is not hunted arbitrarily, and this bird is a symbol of exercising evil spirits. |
|    | Aceros sp. (Aves)                 |                               |                                                                                   |
| 6  | Moluccan scops owl                | Mystical, the incarnation of a Spirit | This owl or Buak is believed to bring misfortune and a sign of someone dying in the village. This bird has different types of sounds, and there is a belief that one of the sounds of this bird brings calamity. The sound of this bird sounds like skin bones which means death. |
|    | Otus magicus (Aves)               |                               |                                                                                   |

Customary rituals applied within the community utilize seven species of animals, including the reptile class’s turtles (Testudines sp.), the aves class’s chicken (Gallus gallus domesticus), hornbill (Buceros rhinoceros), rhinoceros hornbill (Aceros sp.), and moluccan scops owl (Otus magicus), and the mammalia class’s pigs (Sus barbatus), and dogs (Canis lupus) (Table 6).

There are ten species used as food in customary rituals, namely rice (Oryza sativa), pekawai (Durio kutejeinsis), forest rambutan (Castanea argentea), areca nut (Areca catechu), caladium (Caladium sp.), cempedak (Artocarpus integer), pumpkin (Cucurbita sp.), cucumber (Cucumis sativus), and durian (Durio zibethinus) (Table 7).

The communities also use 15 animal species as food, and serve them in customary rituals, namely chicken (Gallus gallus domesticus), pig (Sus barbatus), dog (Canis lupus), deer (Muntiacus muntjak), monitor lizard (Varanus salvator), rice field snake (Phyton reticulatus), softshell turtle (Doga
Table 7. Plants are used as food in traditional rituals

| No | Species name               | Customary ritual          | Customary processions                                                                 |
|----|----------------------------|---------------------------|---------------------------------------------------------------------------------------|
| 1  | Beras (Rice) Oryza sativa (Poaceae) | Offerings in the Kanjan Serayong Customary Ritual | There are three kinds of rice, namely tiny rice, big rice, brown rice, and black rice, used and processed into traditional food, namely lemak, and emping. |
| 2  | Pekawai Durio kutejeinsis (Bombaceae) | Offerings in the Kanjan Serayong Customary Ritual | Offerings in the Kanjan Serayong Customary Ritual, namely fruits of pekawai (yellow durian), limau (forest rambutan), and pinang (areca nut). |
| 3  | Rambutan hutan Castanea argentea (Fagaceae) | Offerings in the Kanjan Serayong Customary Ritual | Offerings in the Kanjan Serayong Customary Ritual, namely fruits of pekawai (yellow durian), limau (forest rambutan), and pinang (areca nut). |
| 4  | Pinang Areca catechu (Areceae) | Offerings in the Kanjan Serayong Customary Ritual | Offerings in the Kanjan Serayong Customary Ritual, namely fruits of pekawai (yellow durian), limau (forest rambutan), and pinang (areca nut). |
| 5  | Keladi Caladium sp (Araceae) | Offerings in the Kanjan Serayong Customary Ritual | Vegetables from garden. |
| 6  | Langsat Lansium domesticum (Meliaceae) | Offerings in the Kanjan Serayong Customary Ritual | Offerings in the Kanjan Serayong Customary Ritual, namely fruits of pekawai (yellow durian), limau (forest rambutan), and pinang (areca nut). |
| 7  | Cempedak Artocarpus integer (Moraceae) | Mystical, the incarnation of a Spirit | This owl or Buak is believed to bring misfortune and a sign of someone dying in the village. This bird has different types of sounds, and there is a belief that one of the sounds of this bird brings calamity. The sound of this bird sounds like skin bones, which means death. |
| 8  | Labu (pumpkin) Cucurbita (Curcurbitaceae) | “Nyabit tahun” | Pumpkins and cucumbers are scraped and eaten with other fruits harvested from the forest. |
| 9  | Mentimun (cucumber) Cucumis sativus (Curcurbitaceae) | | |
| 10 | Durian Durio zibethinus (Bombaceae) | Tempoyak and lempok | Flesh of durian fruit is separated from seeds & then sprinkled with salt and fermented in a tightly closed jar or made “lempok” by means of durian flesh being stirred & cooked. |

Table 8. Animals as food in traditional rituals

| No | Species | Used part | Customary processions |
|----|---------|-----------|-----------------------|
| 1  | Chicken/Gallus gallus domesticus (Aves) | Meat | Animals are used as traditional food at large parties such as traditional wedding ceremonies and priests/shamans. |
| 2  | Pigs/Sus barbatus (Mammalia) | Meat | Animals are used as traditional food at large parties such as traditional wedding ceremonies and priests/shamans. |
| 3  | Dogs/Canis lupus (Mammalia) | Meat | Animals are used as traditional food at large parties such as traditional wedding ceremonies and priests/shamans. |
| 4  | Deer/Muntiacus muntjac (Mammalia) | Meat | Some Dayak people like to hunt, & deer are often used as a food. |
| 5  | Biawak (monitor lizard)/Varanus salvator (Reptilia) | Meat | Some Dayak people like to hunt, & monitor lizar is often used as a food. |
| 6  | Ular Sawah (rice field snake)/Pyton reticulatus (Reptilia) | Meat | Some Dayak people like to hunt, & rice filed snake is often used as food. |
| 7  | Labi-labi (softshell turtle)/Dokania subplana (Reptilia) | Meat | The meat cooked for food. |
| 8  | Tupai ramping (slender squirrel)/Tupaia gracilis (Mammalia) | Meat | The meat cooked for food. |
| 9  | Kodok sawah (rice field frog)/Fejervarya cancrivora (Amphibia) | Meat | The meat cooked for food. |
| 10 | Monyet (proboscis monkey)/Nasalis larvatus (Mammalia) | Meat | The meat can be processed into food or usually smoked to make it last longer. |
| 11 | Udang keci (small shrimp)/Acetes indicus (Malacostraca) | All parts | Shrimp were cleaned, then sprinkled with salt & covered with a jar (fermented). |
| 12 | Bekicot (snail)/Achatina fulica (Gastropoda) | Meat | The meat cooked for food. |
| 13 | Landak raya (Great hedgehog)/(Hystrix brachyura) (Mammalia) | Meat | The meat cooked for food. |

subplana), slender squirrel (Tupaia gracilis), rice field frog (Fejervarya cancrivora), monkey (Nasalis larvatus), small shrimp (Acetes indicus), snail (Achatina fulica), and great hedgehog (Hystrix brachyura) (Table 8).

All plants and animals used for rituals, medicine, and food by customary communities are also potentially developed as a source of learning biology materials under-recognized essential education level competencies (Table 9).

The assessment learning resources of materials used by the customary community were tested to see the acceptable value of these learning materials used in schools (Table 1).

The results of the assessment of learning resources on local materials as a source of science learning for junior high schools are shown in Table 10.
Table 9. Local wisdom and its potential as a source of learning biology

| No | Local wisdom                                                                 | Basic competencies                                                                 |
|----|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| 1  | *Bertangas* or steam bath activities used derived from boiled beluntas          | Class VII, KD 3.4; analyzing the concepts of temperature, expansion, heat, transfer, and their application in everyday life, including the mechanism for maintaining a stable body temperature in humans and animals |
| 2  | A “begondang” dance accompanies the rice harvest to welcome the               | Class VIII, KD 3.1; analyzing motion in living things, motion systems in humans, and efforts to maintain a healthy movement system |
| 3  | Red banana (*Musa sp*) stems are burned and then bandaged on the              | Class VIII, KD 3.1; analyzing motion in living things, motion systems in humans, and efforts to maintain a healthy movement system |
| 4  | Yellow Bamboo Root (*Bambusa vulgaris*) is used to treat jaundice and         | Class VIII, KD 3.5; analyzing the digestive system in humans, understanding disorders related to the digestive system, and efforts to maintain a healthy digestive system |
| 5  | The fat of rice field snakes is made into oil to treat external wounds       | Class VIII, KD 3.7; analyze a circulatory system in humans, understand disorders related to the circulatory system, and efforts to maintain a healthy circulatory system |
| 6  | Bile of the monitor lizard (*Varanus salvator*) has been used in treating    | Class VIII, KD 3.9; analyzing the respiratory system in humans and understanding disorders related to the respiratory system and efforts to maintain a healthy respiratory system |
| 7  | Earth betel leaves (*Clerodendrum thomsoniae*) to treat urinary stones       | Class VIII, KD 3.10; analyze the excretory system in humans and understand disorders related to the excretory system and efforts to maintain the health of the excretory system. |
| 8  | Snakehead fish mucus and meat are used to treat diabetes wounds             | Class VIII, KD 3.10; analyze the excretory system in humans and understand disorders related to the excretory system and efforts to maintain the health of the excretory system. |
| 9  | Owls (*Otus magus*) have different types of sounds, where there is a        | Class VIII, KD 3.11; analyzing the concepts of vibration, waves, and sound in everyday life, including the human hearing system and the sonar system in animals |
| 10 | Semar bags (*Nepenthes mirabilis*) treat birth and breast tumors in all      | Class IX, KD 3.2; analyzing the reproductive system of plants and animals as well as the application of technology to the reproductive system of plants and animal |
| 11 | Small prawns are cleaned, then sprinkled with salt, and fermented in a jar   | Class IX, KD 3.7; applying the concept of biotechnology and its role in human life |
| 12 | Durian flesh is processed into food by a fermentation process called         | Class IX, KD 3.7; applying the concept of biotechnology and its role in human life |

Table 10. The results of the validation of junior high school science learning resources

| Aspect             | 1  | 2  | 3  | Average |
|--------------------|----|----|----|---------|
| Economical         | 4  | 4  | 4  | 4.00    |
| Practical          | 5  | 4  | 4  | 3.67    |
| Flexible           | 4  | 4  | 4  | 4.00    |
| According to the purpose | 4  | 4  | 4  | 4.00    |
| Total average      |    |    |    | 3.92    |

Based on the results presented in Table 10, it shows that school can use local materials as science learning resources with a value of 3.92 for the following reasons:

1. Very economical with a value of 4.00, where learning resources from schools are very close or less than 2.5 km.
2. Practical with a score of 3.67, where using these learning resources is easy to implement.
3. Very flexible with a value of 4.00, where learning resources derived from plants and animals have more than two appropriate basic competencies of learning materials.
4. Very suitable with the purpose, with a value of 4.00, where the components of the learning resources all conform to the objectives of learning science in junior high school.

According to Wahyuni (2015), local wisdom-based science learning can improve students’ critical thinking skills. Local community wisdom has scientific value, and it can be used as a source of learning science (Jufrida et al., 2018). The use of learning resources derived from plants and animals commonly used by the Pesaguan Dayak community can help junior high school students living around Dayak community settlements develop critical thinking skills and scientific knowledge. According to Utari et al. (2021), plants and animals used in traditional ceremonies are also relevant as science material for junior high school students. The senior high school’s study about classification of living things, plant structure and its function, interaction of living things with the environment, the motion of objects and living things in the surrounding environment, and reproduction of plants and animals. The assessment of learning resources on local materials as a source of high school biology learning is shown in Table 11.
Based on the results of the potential assessment learning materials as a senior high school biology learning resource presented in Table 11. Based on the assessment, a school can use local wisdom as a learning resource with a value of 3.75, with the following details:

1. Economical with a value of 3.00, where learning resources from schools are pretty close, between 2.6-5.0 km.
2. Practical with a score of 3.67, where using these learning resources is easy to implement.
3. Very flexible with a value of 4.00, where learning resources derived from plants and animals have more than two appropriate basic competencies of learning resources.
4. Very suitable with the purpose with a value of 4.00, where the components of the learning resources follow the high school biology learning purposes.

Students can use plants and animals as learning materials for junior high and senior high schools regarding economy, practicality, flexibility, and learning objectives to the expectations of junior and senior high school biology. Based on the validation test presented in Table 10 and Table 11, the availability indicator of junior high school biology learning resources with a score of 3.92 or higher than the availability indicator of high school biology learning resources with a score of 3.75. Both junior and senior high school’s locations are very economically where science learning material for junior high school is closer than high school to the presence of plants and animals as a source of learning biology.

**DISCUSSION**

The use of medicinal plants has been carried out since ancient times. It can even be considered the origin of modern medicine, where compounds of plant origin are an essential source of compounds for therapy (Manzano et al., 2020). Dayak Pasaguan community uses plants as medicine by utilizing all plant parts, from the roots to the leaves, and each part of the plant is believed to have its benefits.

The leaf is part of the plant that produces energy from photosynthesis and is mainly used as medicine (Purwanti, 2019). Having many plant leaves, people can take leaves without damaging other parts of the plant to grow and develop. One example of leaves as medicine is Clerodendrum thomsoniae, a species of flowering plant in the genus Clerodendrum of the family lamiaceae. People use the leaf to treat urinary stones and prefer to make boiled leaves water rather than eat the leaves directly. According to Supriyanto et al. (2021), solutes will accelerate the body’s metabolic processes.

The World Health Organization (WHO) estimates that 80% of the world’s population depends mainly on animal and plant-based medicines. The Pasaguan Dayak community used several types of animals for their generations as medicine to heal human diseases. The animals used as medicine, such as reptiles, bears (Helarctos malayanus), hedgehogs (Hystrix brachyuran), and monitor lizards (Varanus salvator). Some animals are now difficult to find in the Dayak community living area because their habitat is damaged due to forest fires used for clearing fields. People also cut trees, practice gold mines, and converted forests for oil palm plantations. Types of rodents such as rats (Rattus rattus) are also used as medicine by drinking water soaked in red rats in "tuaak" (a traditional drink from fermented palm trees). The general public does not commonly use this method, but it has become familiar and has proven effective in increasing the endurance of the Dayak community.

The Pasaguan Dayak community has several traditional ritual events, and one of the most frequently performed traditional rituals is the death customs, called "Nganj". This tradition is a sign of last respect to the dead family. The coconut species (Cocos nucifera) is commonly used in traditional Nganj rituals known as "menumang heads" or burning the head on a tumang stove. In ancient times people burned the human head but now changed with a young coconut fruit. It shows that local wisdom is a positive value that prioritizes elements of harmony and balance between the needs of society and nature (Kusuma, 2018). Young coconut fruit is also commonly used in many places in Indonesia for certain religious ceremonies, including as one of the means of carrying out religious traditions for Hindus in Bali (Pratiwi & Sutara, 2015). The coconut tree is also a versatile tree used for various purposes. According to Kpode et al. (2021), the coconut tree in which its parts are used for multiple purposes, including for food, construction, traditional medicine, and traditional ceremonies.

The bond between humans and nature is demonstrated in the tradition of the Pesaguan Dayak community, known as the annual "Nyapat Year" or Great Harvest events. This ritual is a year-end thanksgiving marked by a procession of fruit and vegetable harvests from the forest accompanied by saggayong music. This musical instrument is made of bamboo (Bambusa vulgaris). Other indigenous peoples in Indonesia also use bamboo for different purposes. The Dayak Kanayatn indigenous peoples in Saham Village of Landak District use bamboo species of Gigantochloa atter, Bambusa eutuldoide, and Schizostachyum brachycladum for traditional ceremonies (Munziri et al., 2013). People around Puri Ubud and Payangan of Bali Province-Indonesia also conserve species of bamboo.
that are useful for traditional ceremonies and usada (treatment) (Arinasa, 2014).

The Pesaguan Dayak people still believe in mysticism, and 71.43% of them use animals as mystical symbols in certain traditional rituals. Several animals are used as mystical symbols, including the hornbill (Aceros sp.), which is believed to be a sacred bird that is a symbol of exorcising evil spirits. The owl (Otus magicus) is believed to symbolize a harbinger of impending death. The belief can help to protect the species from hunting activities, and this prohibition maintains the availability of animals that function as mystical symbols. The availability of turtles (Testudines sp.) and hornbills (Buceros rhinoceros) is limited because people still hunt them for food. Based on the research of Rukeh et al. (2013), Nigerian culture contributes to conserving natural resources by representing natural spirit such as rocks, trees, and forests, also respecting God. These traditional beliefs help preserve the environment and biodiversity conservation through sacred forests. The conditions in the Pesaguan Dayak tribe in West Kalimantan-Indonesia, are not much different from those in Nigeria.

Indonesia has a lot of forest resources richness. People have used plants for their daily needs, including as food sources (Andesmora et al., 2017). In the study area, people can take pekawai (Durio kutejensis) and durian (Durio zibethinus) from the forest and consume them as fruits. The harvesting of the fruit is through a traditional procession known as "panen rayak or mass harvesting" during the harvest season. The Pesaguan Dayak community carries out a customary ceremonial at the main Durio tree in the forest to respect for ancestors. After the procession, people are only allowed to pick fruit such as forest rambutan (Castanea argentea), cempedak (Artocarpus integrum), and other fruit trees grow in the forest. Harvested fruit is then paraded to the community with the accompaniment of senggayong music and consumed by the community with other foods. Other foods derived from plants, including bamboo shoots/saplings (Bambusa vulgaris) used as vegetables and served during a communal meal. Some food is also prepared with the fermentation process, such as durian (Durio zibethinus) processed into "tempoyak" and "lempek", durian fruit which is processed through a fermentation process and can be stored for a longer time.

The Pesaguan Dayak communities use animals for medicine. Besides medical purposes community also use animal as a source of food, such as bears (Helarctos malayanus), hedgehogs (Hystrix brachyuran), and monitor lizards (Varanus salvator). The Pesaguan Dayak community also processed some animal species into food, such as rice field snakes (Phytom reticulatus), rice field frogs (Fejervarya cancrivora), proboscis monkeys (Nasalis larvatus), and snakes (Achatina fulica). A proboscis monkeys (Nasalis larvatus), its meat can be processed into smoked meat. This species is currently prohibited from hunting by the local government, protected by law. Because the community often hunts deer (Muntiacus muntjak), it is not easy to find and needs protection. Wildlife depletion through overhunting is closely linked to food security and community livelihoods as many forest-dwelling or forest-dependent people have few sources of protein and few alternative incomes (Vliet et al., 2012).

Human activities have pushed plant species toward extinction a hundred to a thousand times faster than average. One way to prevent extinction is to promote a better knowledge of plant species to contribute to the success of conservation efforts, such as protecting more land for wildlife and tree species conservation. Actual actions are needed, and they can start from what is already known to prevent the extinction of plants, including animals (Pimm, 2019).

A student should know about endemic plants and animals, and the knowledge has to be transferred from the older generation to the younger generation. Knowledge of exotic species significantly affects local biodiversity in Argentina; 9-17-year-old students in San Juan learn about native and exotic species, the diversity of native wild species, and their importance to ecosystems (Nates, 2010).

The experience of Argentina may be relevant to Indonesia, where plants and animals used for medicine, traditional rituals, and food also have potential as learning resources for science and biology. For Indonesia, the Pesaguan wisdom in using local plants and animals is relevant to the 8th-grade science material with the typical Pesaguan Dayak dance, including a Senggayong Bedansai, traditional Nganjan dance. According to one of the basic competence indicators (KD) 3.1 class VIII and KD 3.5 Class XI, a human movement system. The typical dance movements of the Sungkai tribe (in Lampung Province of Indonesia) are functioning human limbs such as the feet, hands, and fingers. According to Wirbowo (2022), the ability to perform body movements in humans is supported by a movement system resulting from harmonious cooperation between organs of the motion system, such as the skeleton (bones), joints, and muscles.

High school biology learning is a continuation of the material learned in junior high school. Local wisdom for class X can be used as a source for high school biology learning as referred to KD 3.2-analyzing data from observations of various levels of biodiversity (genes, species, and ecosystem) in Indonesia.

Some of the potentials of local wisdom include the root of bajaka (Spalatholobus littoralis) to treat flu and boost immunity. Kapua (Artocarpus elasticus) is a tree species belonging to the moraceae family. The trunk can be used as a building material, while the tree’s bark can be used as clothing (loincloth). It is also relevant to high school biology teaching materials regarding the role of biodiversity in everyday life (Krismanto & Yusniastuti, 2021).

The validation analysis results of this study also showed that endemic plants and animals living in the wild have potential as medicine, food, and rituals and can be used as a source for learning science in junior and biology in senior high schools.

**CONCLUSION**

Plants used as medicine consist of 22 species of medicinal plants from 16 families, most of which belong to fabaceae and poaceae family, followed by asteraceae and lamiaceae and then 12 other families. Animals used as medicine include the pisces class, namely snakehead fish (Channa striata) and catfish (Claris batractus). The reptile class consists of snake (Phytom reticulatus), turtles (Manouria emys), monitor lizards (Varanus
Salvator), house lizards (Hemitactylus platyurus), and geckos (Gekko gecko). Class mammals, namely bears (Helarctos malayanus), hedgehogs (Hystrix brachyuran), and rats (Rattus rattus).

The plants used in traditional rituals consist of 15 species that have the potential for customary rituals. These rituals use six species of animals. They are reptile class, namely turtles (Testudines sp.), aves class, namely chickens (Gallus gallus domesticus), hornbills (Bucerus rhinoceros), hornbills (Aceros sp.), and mammals class consist of pigs (Sus barbatus) and dogs (Canis lupus).

Customary communities as indigenous peoples also use plants as food served at traditional ritual events, namely rice (Oryza sativa), pekawai (Durio kutejeinsis), forest rambutan (Castanea argentea), pinang (Areca catechu), keladi (Caladium sp.), cempedak (Artocarpus integer), pumpkin (Cucurbita sp.), cucumber (Cucumis sativus), and durian (Durio zibethinus).

There is some potential for indigenous food found in 13 animal species of 15 families. They are eagle (Haliaeetus leucoryphus), leopard (Panthera pardus), deer (Muntiacus muntjak), monitor lizards (Varanus salvator), rice field snake (Python reticulatus), softshell turtle (Doggania subplana), slender squirrel (Tupaia gracilis), rice field frog (Fejervarya cancrivora), monkey (Nasalis larvatus), small shrimp (Aedes indicus), snail (Achatina fulica), great hedgehog (Hystrix brachyura).

Ethnobiology research results on plants and animals that have the potential as medicine, food, and rituals can be used as a source of learning material for junior high school and senior high school. There is a need for further research on ethnobiological studies on other Dayak tribes in West Kalimantan to protect natural resources.

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