# Ethnoveterinary Plants Used by Local Farmers in the Promotion of Livestock Health in Selected Districts of Sarawak Borneo: A Preliminary Study

**Mohammad Nasir, H.[1], Masnindah, M.[1], Kamil, L.[1], Lirong, L.A.[1], Noorasmah, S.[1], Suziana, H,.[1], Sharifah Salmah, S.H.[2], Suhaili, M.[1], M. Hakim, M.A.H.[1], Paul, B.T.[1], Herinda, P.[4], Sarah, Al-Twain[5] & Juriah, K.[1,3]***

[1]Faculty of Agricultural Science and Forestry, Universiti Putra Malaysia Bintulu Sarawak Campus, Bintulu 97008, Sarawak, Malaysia.
[2]Faculty of Veterinary Medicine & [3]Institute of Tropical Agriculture and Food Security, Universiti Putra Malaysia, Serdang 43400, Selangor, Malaysia
[4]Faculty of Vocational Studies Airlangga University, Jalan Dharmawangsa Dalam 28-30, Surabaya 60286 Indonesia
[5]Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

*Correspondence: juriahk@upm.edu.my

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## Abstract

Ethnoveterinary plant medicines are an alternative method to treat various diseases in livestock. The majority of the world's plant species are found in tropical forests. Thus, the present study aims to use a participatory methodology to identify livestock owner knowledge, attitudes and beliefs relating to the use of medicinal plants for animal treatments in selected districts in Sarawak, Malaysian Borneo. The data were collected using an online questionnaire and via phone interviews with 78 respondents. Only 39.7% of the respondents used this practice. The results showed that 22 plant species were used locally for treating various diseases in the studied area. Plant leaves were commonly used, crushed in water or feed and boiling, and administered topically and orally. Akar patawali (*T. crispa*) and sambong (*B. balsamifera*) were identified as potential plant-based remedies that can be explored in future studies. There were advantages of using plant-based remedies: low in cost, easy to cultivate and available locally. This documentation on the plant species associated with indigenous knowledge of small-scale farmers may, in the future, help educate younger generations and promote livestock health care. Further research is required to investigate other potential uses of plant-based preparations as*modern* traditional drugs in this region.

**Keywords:** Sarawak Borneo, current knowledge, ethnoveterinary plants, livestock diseases

## Introduction

Ethnoveterinary plants are used either as traditional medicinal plants or as herbal remedies for basic health care for livestock diseases in Malaysia (Chandrawathani *et al.*, 2006). The use of medicinal plants as an alternative dewormer, for instance, can help farmers to reduce production costs by treating their animals traditionally. On that note, control that relies heavily on the use of

anthelmintic drugs is being threatened by the widespread occurrence of drug resistance (Juriah *et al.,* 2019). Therefore, these circumstances require every possible effort to utilize medicinal plants available in the locality. Traditional medicinal plants are mostly used in crude forms; however, the pharmacological preparations, dosages and mode of action are not based on strong scientific affirmation.

Ethnoveterinary medicines, including bioactive plants, have been proven to contain natural compounds that are considered effective and cheap sources of medicines to complement commercially manufactured drugs for the treatment of a variety of health problems in humans and animals *(Nfi et al.,* 2001). The administration and cultivation of bioactive forages and phytotherapy show promising potential of being health-promoting agents. A previous study reported that dietary supplementation with forages containing condensed tannins may enhance the nutrition of the host and possibly have direct anthelmintic properties (Hoste *et al.,* 2015). For example, plants with higher tannin content including *Azadiracha indica* (neem) and *Carica papaya* (papaya) had an anthelmintic effect on parasites (Hounzangbe-Adote *et al.,* 2005; Levecke *et al.,* 2014).

The use of ethnoveterinary plants as an alternative feeding source and antibiotics in livestock production is now attractive. Several studies indicate that herbal feed additives can also improve the health and immune function of animals (He *et al.,* 2016; Malahubban *et al*., 2013a). Other studies have also demonstrated that garlic (Boonpeng *et al.,* 2014), *Andrographis paniculate*, *Orthosiphon stamineus* (Malahubban *et al.,* 2013b) and *Moringa oleifera* (Yousef *et al.,* 2018) have several pharmacological effects, such as being anti-parasitic, anti-inflammatory, anti-microbial, antioxidant, hepatoprotective, anti-glycemic and anti-dyslipidemia. There is rich diversity of plant species in Sarawak forest, and in addition, different local communities across this region have indigenous experiences and perceptions of various ethnoveterinary medicinal plants. Although many potential ethnoveterinary plants can be used as dietary supplements in livestock the current status of information on this practice is still scarce in this region. Therefore, this study aimed to use a participatory approach to explore livestock owner knowledge, attitudes and beliefs relating to the use of plant-based local remedies for sick animals in Sarawak.

## Methodology

*Study approaches*

The data collection was gathered from a range of useful information and focused on important factors required in developing the questionnaire. Those approaches have been done to gather in-depth information and ensure data accuracy: Three (3) selected farmers in Bintulu, Sarawak (3.1713°N, 113.0419°E) were interviewed via a telephone call. These farmers were selected to identify and collect all the relevant information needed, this information was subsequently utilized as the primary data for the present study. They were asked open-ended questions to investigate the evaluation of the usage of traditionally applied plants; a questionnaire was then formulated from their responses. Prior to distributing the questionnaire to respondents, the questionnaire was piloted randomly on two farmers. This was to ensure the questions were understandable; improvements to the questionnaire were then made.

*The survey instruments*

Closed-ended and open-ended questions were prepared for the questionnaire used in this study. The questionnaire was divided into five sections according to the (i) demographic information of the respondents, (ii) types of

livestock, (iii) application of ethnoveterinary plants and (iv) preparation of the ingredients and mode of administration. The questionnaire was distributed to 100 farmers in Borneo Sarawak. An online questionnaire was created in Google Forms and published through social media. Individuals who did not have access to the Internet or WhatsApp were interviewed by phone prior appointment. One survey assistant was employed throughout the data collection to conduct phone interviews. The role of the interviewer was to facilitate respondents' answering of questions by providing adequate information to respondents during the interview session. The survey was conducted between May 2020 and July 2020. The data was subsequently converted to Excel from Google Sheets.

*Study Design, Study Area and Selection of Sample Sites*

A cross-sectional study was conducted involving the selection of local farmers in Sarawak, Malaysia. The sampling sites were selected based on the availability of fresh meat from animals slaughtered locally in the study area. As shown in Figure 1, sampling sites were: Bau: 1.4172° N, 110.1546° E, Miri: 4.3927° N, 113.988° E, Lawas: 4.8596843° N, 115.4082501° E, Sibu: 2.2873° N, 111.8305° E, Marudi: 4.1793687° N, 114.321109° E, Limbang: 4.7534355° N, 115.0093036° E, Kanowit: 2.1012° N, 112.1533° E, Kabong: 1.804° N, 111.119° E and Sri Aman: 1.237° N, 111.4621° E.


Figure 1. The map of Sarawak. The colour circles denote the sampling areas in nine districts in Sarawak, Malaysia.

## Results

*Socio-demographic & Socio-economic*

The demographic information from the 78 respondents is shown in Table 1. The majority of the respondent were males (66.7%) and fewer females participated in the study (33.3%). Most of the participants were involved in poultry farms (44%). The age range was wide and most participants were aged over 50 (53.9%). Most participants had between 1 and 5 years (29.5%) of experience in the livestock industry.

Table 1. Socio-demographic & Socio-economic characteristics of respondents (n=78)

| Variable | Category | Frequency | Percentage (%) |
|---|---|---|---|
| Gender | Male | 52 | 66.7 |
| | Female | 26 | 33.3 |
| Age | 21 – 30 | 15 | 19.2 |
| | 31- 40 | 5 | 6.4 |
| | 41 – 50 | 16 | 20.5 |
| | Above 50 | 42 | 53.9 |
| Type of enterprise | Cattle | 7 | 9 |
| | Goat | 8 | 10 |
| | Poultry | 34 | 44 |
| | Pigs | 13 | 17 |
| | Rabbit | 2 | 2 |
| | Fish | 1 | 1 |
| | Integrated | 13 | 17 |
| Number of Livestock | 1-50 | 42 | 54 |
| | 51-100 | 14 | 18 |
| | 101-150 | 8 | 10 |
| | 151-200 | 8 | 10 |
| | Above 200 | 6 | 8 |
| Years of Experience | 1 – 5 years | 23 | 29.5 |
| | 6 – 10 years | 21 | 26.9 |
| | 11-15 years | 12 | 15.4 |
| | 16-20 years | 14 | 17.9 |
| | Above 20 years | 8 | 10.3 |

*Ethnoveterinary plant*

In the present study, 60.3% of the respondents did not use ethnoveterinary plants and only 39.7% of the respondents used such alternative treatments for their livestock (data not shown). Out of 39.7% of respondents that use ethnoveterinary plants, most of the respondents self-cultivated plants (38%), followed by obtaining plants from a mixture of sources (28%), buying from a market (25%) and a few respondents collected plants from the wild, 9% (Figure 2).

Plant parts that were used in the present study are presented in Figure 3. A total of 22 plant species were used locally with various plant parts and combinations of other ingredients for treating various diseases in the studied area (Table 2).

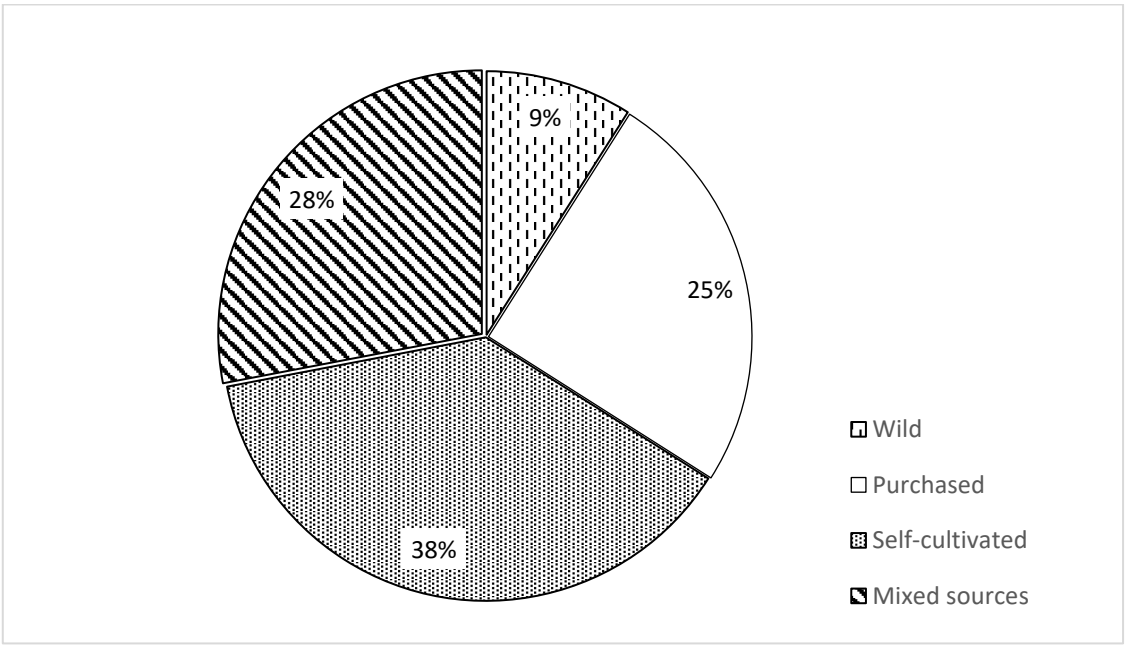


Figure 2. Source of ethnoveterinary plants, in percentages.

Table 2. Categories of diseases, list of ethnoveterinary medicinal plants, part of plants used, mode of administration, and animal species that were utilized by respondents for livestock healthcare in Sarawak Borneo.

| # | Disease | Local name | Scientific name | Type of plant | Part of plant used | Mode of administration | Animal species |
|---|---|---|---|---|---|---|---|
| 1 | External parasites (Mange) | Patawali | *Tinospora crispa* | Herb | Root | Crushed and boiled; animal is bathed once a day. | Pig |
| | | Sambong | *Blumea balsamifera* | Shrub | Leaf | Crushed; directly rubbed into parasitic/infected skin. | Pig |
| | | Garlic | *Allium sativum* | Herb | Bulb | Crunched; mixed | Poultry, pig |
| | | Lemongrass | *Cymbopogon citratus* | Herb | Leaf | with feed once a day | Pig |
| | | Lemon | *Citrus limon* | Tree | Fruit | OR | Pig |
| | | | | | | Garlic, lemon and lemongrass are crushed and burned; used to smoke the pig house during the early morning. | |

| # | Disease | Local name | Scientific name | Type of plant | Part of plant used | Mode of administration | Animal species |
|---|---|---|---|---|---|---|---|
| 2 | Bacterial infection / Wound treatment | Turmeric | *Curcuma longa* | Herb | Rhizome | | Poultry, Cattle, Goats |
| | | Wild tea | *Acalypha siamensis* | Shrub | Leaf | | Goats, cattle |
| | | Soursop | *Annona muricata* | Tree | Leaf | Grinded; | Goats, cattle |
| | | Daun sirih | *Piper betle* | Shrub | Leaf | scrubbed/applied | Poultry |
| | | Coffee | *Coffea liberica* | Shrub | Leaf | topically to skin | Poultry |
| | | Galangal | *Alpinia galanga* | Herb | Rhizome | wound. | Poultry |
| | | Temulawak | *Curcuma zanthorrhiza* | Herb | Whole plant | Blended; mixed with | Poultry |
| | | Black Pepper | *Piper nigrum* | Shrub | Peppercorn | water or feed. | |
| 3 | *Gastrointestinal problems | Papaya | *Carica papaya* | Shrub | Leaf | Chopped/grinded; | Cattle, Goat, |
| | | Ginger | *Zingiber officinale* | Herb | Rhizome | mixed in the animal | Cattle |
| | | Turmeric | *Curcuma longa* | Herb | Rhizome | feed. | Poultry |
| | | Garlic | *Allium sativum* | Herb | Bulb | | Poultry |
| 4 | Immune booster | Sengkuang | *Pachyrhizus erosus* | Herb | Corn | Blended with other | Pig |
| | | Torch ginger | *Etlingera elatior* | Herb | Rhizome | ingredients; mixed | |
| | | Cassava | *Manihot esculenta* | Shrub | Leaf | with feed. | |
| 5 | Dietary supplement | Rumput kerbau | *Paspalum conjugatum* | Herb | Leaf | Blended with ‘soy sauce’; mixed with | Poultry, pig |
| | | Bitter melon | *Momordica charantia* | Herb | Fruit | feed. | |

| # | Disease | Local name | Scientific name | Type of plant | Part of plant used | Mode of administration | Animal species |
|---|---|---|---|---|---|---|---|
| 6 | Toxins | Pandan | *Pandanus amaryllifolius* | Shrub | Leaf | Dried for 2 hours; administer orally daily. | Rabbit |
| | | Coconut | *Cocos nucifera* | Tree | Fruit | Young coconut water is mixed in animal drink at night only. | Goats |

*Diarrhoea, bloat, internal parasites

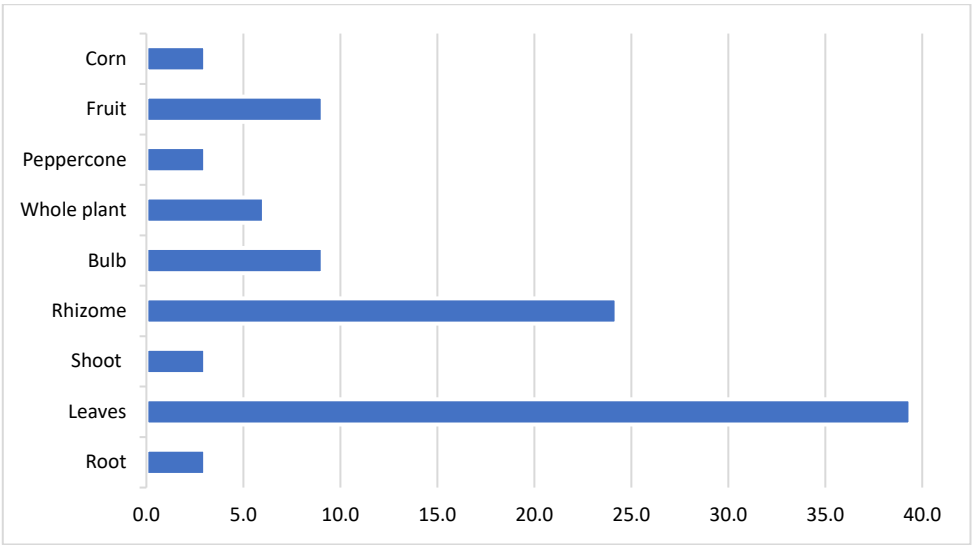


Figure 3. Parts of the plant used by respondents, in percentage.

Herbs (11 species) were found to be the most used ethnoveterinary medicinal plants followed by shrubs (8 species) and trees (3 species).

*Type of diseases*

The most common diseases that were treated by ethnoveterinary medicinal plant species were maggots in wounds, and deworming for internal and external parasites (Table 2.).

*Source of knowledge*

In relation to the source of their knowledge on ethnoveterinary plants, most of the respondents indicated that knowledge was passed from generation to generation (45%), followed by their own experiences (26%), reading an article (13%), information from friends (7%) and Indonesian breeder (6%), or from the veterinary department (3%) (Figure 4.).


Figure 4. Source of ethnoveterinary knowledge among 78 respondents.

## Discussion

The use of natural plants as traditional and modern remedies for humans and livestock has long been practised, however scientific validation of these practices and identification of active compounds has been lacking (Githiori *et al.,* 2005; Tolossa *et al.*, 2013). Little has been done in this region, even though a lot of ethnoveterinary plants are currently used in tropical countries and have been practised by many ethnic groups across the globe (Sanz-Biset *et al.,* 2009). Therefore, the current study empirically investigated the ethnoveterinary practices among the local people; detailing the description of the plant parts that are used and the mode of administration. To the best of our knowledge, this is the first attempt to determine the local livestock owner's knowledge, attitudes and beliefs relating to the use of medicinal plants for animal treatments in Sarawak.

In the present study, male respondents were higher than the female. This is because livestock production is usually a cultural preserve for males who are responsible for the upkeep and marketing of large animals such as cattle and buffaloes. Whereas women tend to manage smaller animals as their energy and nutritional requirements rise during menstruation, pregnancy and lactation (Behrman *et al.,* 2004). Overall, most elders involved in the livestock industry suggest that livestock ownership and knowledge of ethnoveterinary plants peaks during this age range. These findings are consistent with the results obtained from previous studies indicating that middle and older age groups have more experience in farming and livestock management (Verma & Banafar, 2014). Our findings also described that the respondents mostly gained their ethnoveterinary plant knowledge from their own experience or via word of mouth, generally being passed down to them through generations (Figure 4). Likewise, the increase in the number of years of working may impact on the accumulation of experience related to these practices, suggesting that it may raise their knowledge of commonly used ethnoveterinary plants for medicinal purposes in this region. However, this is not the case in our study due to the scarcity of respondent number. Thus, further studies would be necessary to understand better the correlation between farmer background and their traditional knowledge of medicinal plants that are used to treat livestock diseases.

In the present study, the majority of the participants were small-scale farmers. Only 39.4% (n=25) of the respondents used their traditional knowledge of medicinal plants in treating livestock diseases. Practising traditional medicine for this group is reliable because farmers are close to their livestock and can easily and quickly identify sick animals. These medicinal plants are also readily accessible, especially for rural farmers. For example, farmers in various under-developed regions and small-scale operations use medicinal plants for treating livestock diseases due to the lack of modern veterinarians and the high price of commercially available drugs (Siegmund-Schultze *et al.,* 2012). The use of medicinal plants is cheap and low cost for the farmers as they are easy to obtain and prepare (Saha *et al.,* 2014). This is not surprising as *Tinospora crispa* (*akar patawali*) and *Blumea balsamifera (sambong)* are known to Borneo Forest resources (Table 2.). *Sambong* has also been reported as an indigenous leafy vegetable which is commonly consumed by the local communities in the rural areas of Bintulu (Noorasmah *et al.,* 2020). As for *akar patawali*, it is known to have antioxidant, cytotoxic and some antimicrobial activity that may be useful for traditional medical uses (Amirul *et al.,* 2011). Thus, the trend of "going back to nature" might introduce this forest plant as a source of alternative medicine. The present findings also suggest

that local people have indigenous knowledge of ethnoveterinary medicinal plants in Sarawak, and this knowledge can be part of the development of ethnoveterinary plants for use in livestock.

There were about 22 plant remedies for 6 categories of different ailments which the farmers use (Table 2). Overall, leaves were the most commonly used plant part; followed by rhizomes (Figure 3). These findings are consistent with the results obtained from previous work that suggested that leaves were part of the ethnoveterinary medicinal plants frequently used by small-scale farmers (Parthiban *et al.,* 2016). As these plant parts are easily harvested, unlike the roots, this is not labour-intensive for the farmers and also will not permanently damage the plants. When bulbs, barks, stems, shoots, or whole parts of the plant are used in the medicinal preparation this will affects the survival of the mother plants. Harvesting of roots compared to the harvesting of leaves can have significant positive impacts on the species and ecosystems. Thus, the knowledge and skills of these local people are important to ensure the sustainable utilization of the plants. Moreover, *T. crispa* is one of the potential local traditional medicines, as healthcare practitioners highlighted its popular use as a general tonic, antipyretic, diabetes, hypertension, backache, internal inflammations and others (Aminul *et al.,* 2011); and also as an anti-parasitic agent in both humans and domestic animals (Rungruang & Boonmars, 2009). This is not surprising as *T. crispa* has received much interest in Malaysia and Forest Research Institute Malaysia (FRIM) has named this plant in their future research prospects.

In the present work, several plant species were used to treat various livestock diseases (Table 2). Pig mange was managed using *T. crispa* and *B. balsamifera*. This is the first report to demonstrate the potential of both plants being used in treating ectoparasite in pigs. Reports from other studies indicated that herbal-based plants including hogweed (*Heracleum sosnowskyi* Manden), mugwort (*Artemisia vulgaris* L.), tansy (*Tanacetum vulgare* L.) and wormwood *Artemisia absinthium* L.) were used to treat pig mange mites and the authors confirmed that the hogweed seeds showed a significant effect (Mägi *et al.,* 2006). The antioxidant properties of *T. crispa* stem extract have also been used against malaria (Jiraungkoorskul, 2019). In the Philippines, through *in vivo* study, sambong or *B. balsamifera* leaves were used against an oriental fruit fly, *Bactrocera dorsalis* (Paragas *et al.,* 2020). As these two plants are widely found in Asia and Southeast Asia, they have the highest value and their diverse use emphasizes the importance of the present study. Further investigation of the efficacy and formulation that can be easily handled by local communities is needed to achieve a significantly increased use of such practices.

Of all the plants named by participants, papaya (*Carica papaya*) was mostly used in treating livestock diseases. The use of papaya for deworming was also described in other previous studies (Levecke *et al.,* 2014; Stepek *et al.,* 2004). It has been used traditionally in the Philippines and other countries. Furthermore, the usage of herb plants by local inhabitants of many cultures, both ancient and modern, in daily life is very common and often used to treat ailments and maintain health (Rethy *et al.,* 2010). These natural plant-derived products are also known as a healing food and have been known over the centuries in different parts of the world. Thus, results from the present study suggest that the usage of these traditional medicines is heavily dependent on locally available plant species (Figure 2), and capitalizes on traditional wisdom-repository of knowledge (Figure 4). Another reason is that it was an affordable and well-documented treatment for various

diseases in humans and animals (Boonpeng *et al.*, 2014; Malahubban *et al.*, 2013a, b).

The preparation methods described were relatively straightforward forward often fresh leaves or rhizomes were crushed or boiled and mixed into the livestock feed or drink, which was then administered. This is in line with previous reports in other ethnoveterinary plant studies (Parthiban *et al.*, 2016). Interestingly, the freshly crushed leaves were also rubbed into infected skin as a normal practice in human traditional healers practitioners in Borneo. Water is commonly used to make a solvent and surprisingly in the present study, soy sauce was also used as an additional ingredient in poultry and pig feed. Thus, it is clearly shown that each local community has slightly different preparation methods or it is more 'trial and error' taste recipes involved when extending the use of medicinal plants. As ethnoveterinary plants' knowledge and their belief is passed on via word of mouth and generally stays within family generations, thus documentation of this practice as well as collecting further new information is urgently needed. This is to ensure that all information on ethnoveterinary medicine plants' usage does not disappear. Other participants also shared information about using raw chicken egg and antiseptic dusting powder Agnesia® (not reported here). They believed that raw eggs can improve the poor suckling reflex of newborn kids to treat the upset tummy. The latter was used to treat ringworm on goats as this medicated powder contains protectant and dermatological ingredients that are used to cure heat rash or prickly heat, nappy rash or cosmetic rash in humans. On that note, there are elements of tradition, belief and superstition surrounding this practice.

## Conclusions

This is the first study to report the identification of medicinal plants for veterinary usage in Sarawak Borneo. Among the 22 plant species, herbs were the most used plant in the area. The leaves are the part favoured by the local users. All the reported plants were cheap and locally available in this region. *Akar patawali* and *sambong* are potential plant-based remedies that can be explored in future studies. Additionally, further investigation is required to discover other potential forest plant-based remedies for treating livestock diseases in Borneo. Results from the present study will be used as the guidelines for an *in vitro* study against helminth infections and the conservation of the medicinal plants of this area.

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**Conflicts of Interest**

The authors declare they have no conflict of interest.

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