

## Ethnobotanical Study on the utilized of medicinal plants by the Phouthai Ethnic Group in Khammouan Province, Lao PDR

Khambay Khamphilavong<sup>1,2\*</sup>, Lili Zhang<sup>1</sup>, Metmany Soukxhavong<sup>2</sup>, Muhammad Awais<sup>3</sup>, and Yongxiang Kang<sup>1</sup>

<sup>1</sup>College of Forestry, Northwest A&F University, Yangling, Shaanxi, 712100, China.

<sup>2</sup>Department of Forest Community and Rural Development, Faculty of Forestry Science, National University of Laos.

<sup>3</sup>State Key Laboratory of Crop Stress Biology for Arid Areas, College of plant Protection, Northwest A&F University, Yangling, Shaanxi, 712100, China.

### \*Corresponding Author

Khambay Khamphilavong, College of Forestry, Northwest A&F University, Yangling, Shaanxi, 712100, China.

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### Abstract

**Background:** Plants have been a part of rural areas' people's life from birth to die since prehistoric times and their utilization is an important traditional culture in the worldwide. However, this is a lack of ethnobotanical study in Laos. The aim of the study is to record the plants' species and explore their medical utilization in Nakeu village, Hinboon district, Khammouan province, middle part Laos.

**Methods:** Ethnobotanical survey was conducted from August 2018 to July 2019. One hundred and fifty key information (81 males and 69 females). Ethnomedicinal data were collected through semi-structured interviews with key informants.

**Results:** The total 79 plant species belong to 46 families were recorded as wild medicinal important. Life form importance value (LIV) was highest in tree 52%, followed by shrub 29%, liana 14%, grass 4%. The medicinal plants are used for stomach problems, heart disease, kidney problems, fever, and others, respectively. Used value (UV) was highest in *Ocimum americanum* (0.93). This knowledge will support primary health care providers and policymakers in decision-making on the utilization of medicinal plants.

**Conclusion:** In Hinboon district, Khammouane province, Lao PDR, are some of the richest in species of medicinal plants in developing countries, and indeed in Asia. It is worth pointing out the exceptional long list of medicinal plants which are used for traditional medicine and documented as used in the treatment of different common sicknesses. Health policies have to promote the utilization of medicinal plants as part of a strategy to improve the basic health and livelihoods of rural communities throughout the country. Further exploration is needed on the bioactive compound and chemical factor contents of medicinal plants.

**Keywords:** Medicinal Plants, Traditional Knowledge, Ethnic Group, Laos

### Introduction

Plants have been a part of the rural area's people's lives since prehistoric time, and is evolving into an essential traditional cultures worldwide where native peoples used it from birth to death [1-3]. Different kinds of plant species are rare and precious medical resources and environmentally friendly building materials [4]. Generally speaking, they could be used to treat illness and disease, health tonic, and are important in primary healthcare around the world [5]. Especially in rural area far away from the hospital. Even

though in developed countries such as Australia, Canada, France, Belgium, America, a high percentage of the population also treated plants as traditional medicines [6-8]. Since modern medicines were dissolved or synthesized the basic on of previous plant derivatives, and the extraction of bioactive compounds from plants as plant derivatives always took a lot of time, expertise and money, the search for traditional medicinal plants can help reduce the cost of drug discovery [9, 10]. At the same time, traditional knowledge was being eroded by several processes related to globalization and

urbanization [11-13]. Because people in each region of the world had different historical backgrounds, cultures and ways of life, and the flora of their environment is different, they used plants as medicines in different patterns, such as different plant species with different plant parts, preparation methods and applications in medicine [14-16].

Although some mode preparations can use any or all parts of the plant, most medicinal plants are usually strictly related to specific parts of the plant, such as roots, stems, leaves [17-21]. Screening of plant parts usually depends on the organ with the highest concentration of bioactive substances acting in the treatment [1, 11, 13, 22-24]. But since not all traditional medicines rely on physiological effects, other parts can also be used. The preparation of this drug was inherited from the traditional culture and it can be done using various solvents, such as boiling, soaking in water or alcohol [1, 13]. Crushing without extraction, and ingesting without any preparation. The medicine can be used as a drink, tablet or without any preparation. Finally, the way of administration varies from ingestion to smoke inhalation to external application to the injured area of the body [1, 19, 25-27]. All these differences can be due to the different cultural, geographical and temporal dimensions.

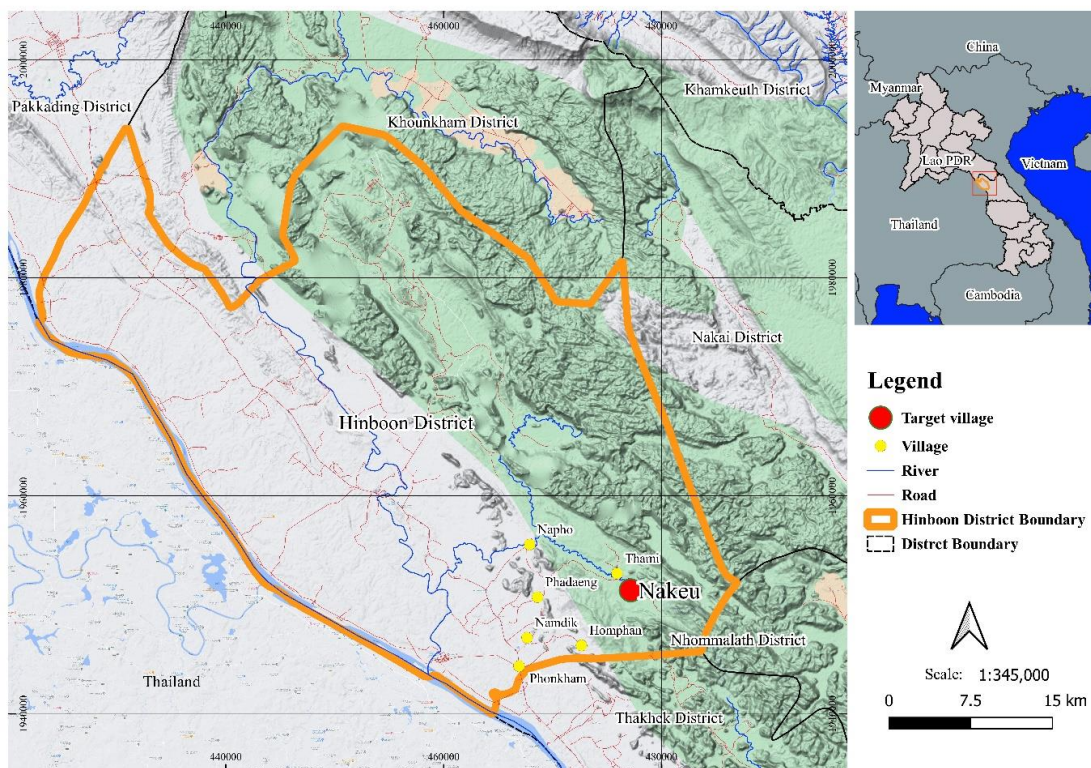
The rural population relies almost entirely on traditional medicine for primary health care and is highly dependent on medicinal

plants due to the lack of modern health services. Although many of number medicinal plants have been known and used by the local community, no one has recorded their knowledge until now. Traditional healers usually pass on medicinal knowledge to the next generation through oral language [27-29]. In this way, some crucial of key information would be misunderstood or missed. In addition, there is a lack of sufficient reference knowledge on the use of ethnic medicinal plants among the frequently cited problems in research [14]. Therefore, the current study is urgently needed and carried out mainly from these aspects. Firstly, how many kinds of medicinal plants there are in the Hinboun area of Khammaun Province of the Laos? Secondly, what is the specific function of the medicinal plant and how to use it?

## Materials and Methods

### Description of the Study Area

The study was conducted in the Phouthai communities at Nakeu village Khammaun province, Laos "Figure. 1". It is located 33 km far away from the town, the geographically situated between 17°64' -86°78' N and 140°78'-48°57' E, the total land area of 35,863 ha. The mean monthly temperature is 32 °C, ranging from 15 °C to 38 °C, and total rainfall is 1200 mm, ranging from 600 to 1600 mm and mostly of forested mountainous terrain.



**Figure 1:** Location of the study sites in Nakeu village Hinboun District, Khammaun Province.

## Fieldwork

Ethnobotanical survey was conducted from June 2018. Prior acquisition of necessary ethics approval and informed consents were acquired before the actual interview. The consultation meetings and discussions were conducted together with the District of Agriculture and Forestry of Office (DAFO), and village leaders. The field collection and direct observation between August 2018 to July 2019 to generate a list of medicinal plants that local people gather around their village. One hundred and fifty key informa-

tion (81 males and 69 females, aged range 28-44, 45-61, and 62-78 years (Table. 1). Ethnomedicinal data were collected through semi-structured interviews with key informants [22, 23]. We were asked them to show plant specimens and photographs, and were asked for plant names (local name), part used, and modes of preparation, mildew treatment, habits and other information were recorded. In addition, three focus group discussions were conducted with ten older people with traditional knowledge (male, and female).

**Table 1: The information of the key informant**

Age group	Total key informants	Male	Female
28-44	81	49 (60.49%)	32 (49.38%)
45-61	57	31 (38.27%)	26 (37.68%)
62-78	12	1 (1.23%)	11 (15.94%)
Total	150	81	69

## Collection and Identification

Verifiable species identification of medicinal plants was conducted during field walk with the assistance of the guide from DAFO and traditional healer from village for the record of the local names. And then was literature available in our University and internet resources, take into consideration present Lao plant checklists [24] [30] All botany names were checked for spelling and synonyms, and family classification using the word flora online (<http://www.worldfloraonline.org>), <https://padme.rbge.org.uk/laos/list/>.

## Data Analysis

### Use Value (UV)

The relative significance was calculated employing the UV [31] a quantitative measure for the relative significance of species known locally.

$$UV = \frac{\sum Un}{N}$$

Where  $U_n$  is the use numbers of plants by each informant for a given species while  $N$  is the total number of informants. The UV are high when there are many use reports for a plant, mean that a plant is significant, and approach zero when there are a few reports related to its use.

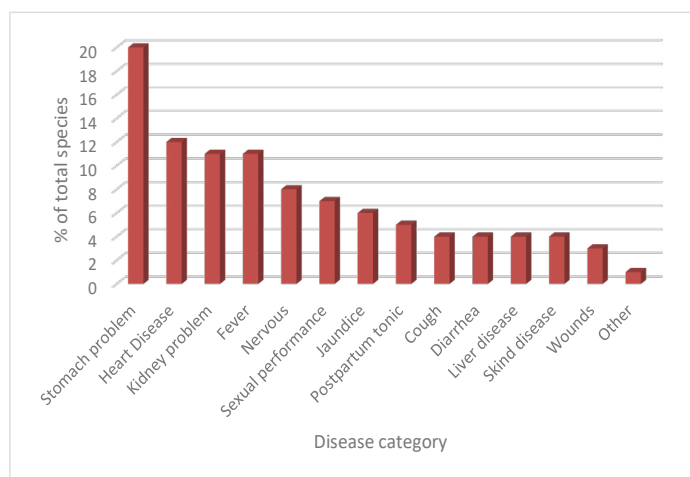
## Statistical Analyses

Statistical tests were performed to test difference between the knowledge of different age groups. The numbers of medicinal plants known by informant and continuously variable of informant age were analyzed using linear regression. The using report of medicinal plants between males and females were compared using Chi-square statistics, t-test and analyzed of p-value [26].

## Results

### Medicinal Plants Species

A total of 79 medicinal plant species belong to 46 families (Table 2). The commonly used families were Fabaceae 10.12% (8 species), Euphorbiaceae 7.59% (6 species), Annonaceae, Apocynaceae, Moraceae, Ophyllanaceae, Rubiaceae, and Rutaceae 3.79% (3 species in each), and Araliaceae, Bignoniaceae, Combretaceae, Dilleniaceae, Lamiaceae, Lauraceae, Menispermaceae, Poaceae, and Simaroubaceae 2.53% (2 species), see in the "Figure. 2". The distinctive plant parts used in preparations both in single and multiple treatments are: roots 29 species (33%), stems 27 species (31%), leaf 13 species (15%), fruits 8 species (9%), whole plants 6 species (7%), and barks 5 species (5%) see in the "Figure. 3". which are medicinal used for stomach problem, heart disease, kidney problem, and fever, respectively, based on the frequency of informant citation see in the "Figure. 2"



**Figure 2: Disease category treated by different medicinal plant species in Hinboun district, Khammouan province.**

TABLE 2

Local names	Botanical name	Family name	Plant form	Part used	Mode of preparation	Ethnomedicinal uses recorded in the present study	UV	Ethnomedicinal uses reported by other researchers
ນາວ ນາ°	Artabotrys spinosus Craib		tree	Stem	Boiled	Kidney problem	0.02	Not found
ແຕງແລງ	Cananga latifolia Finet & Gagnep	Annonaceae	tree	Roots	Soaked with cold water	Fever	0.14	(Chassagne et al. 2017)
ກາລຸງດງ	Cyathostemma micramthum (A. DC.) J. Sinclair		liana	Stems	Soaked with alcohol/boiled	Infertility, Dysmenorrhea, Syncope	0.79	
ຫຍາ ອຸງນອ	Cyathula aspera (L.)	Amaranthaceae	grass	Whole plant	Boiled	Health tonic	0.02	Not found
ສມ ລມ	Aganonerion polymorphum Pierre ex Spire.		liana	Roots	Boiled	Kidney problem	0.02	(Sarwar 2015; Li and Xing 2016; Rani et al. 2011)
ຈາ ປາແດງ	Plumeria rubra L.	Apocynaceae	tree	Roots	Boiled	Nervous	0.04	(De Boer, Lamxay, and Björk 2012;
ຕາເປັດ	Alstonia scholaris (L.) R.Br		tree	Stems	Boiled	Paralysis	0.01	Khonkayan, Saengsiri, and Thipsontae 2019; Garcia 2021)
ຜ ຫຍກ	Centella asiatica (L.) Urban	Apiaceae	shrub	Whole plant	Boiled	Health tonic	0.01	
ຫວາຍສະນອຍ	Pothos scandens L.	Araceae	liana	Stems	Boiled	Health tonic	0.04	(Mi et al. 2021) (Cordell 1991)
ຜາລາຍ/ເລ ບມ ນາງ	Schefflera elliptica (Blume) Harms	Araliaceae	tree	Roots	Boiled	Stomach problem	0.02	(Srithi et al. 2012;
ຜກ ຕາ	Schefflera heptaphylla (L.) Frodin		tree	Stems	Soaked with alcohol	Nervous	0.09	Sothearith et al. 2021; Rani et al. 2011; Mi et al. 2021)
ຫຍາ ຝຣ ງ	Chromolaena odorata (L.) R. King & H. Robinson	Asteraceae	shrub	Stems	Boiled/Raw	Stomach problem/Wound	0.57	(Sarwar 2015; De Boer, Lamxay, and Björk



ຫວາ	Aloe vera (L.) Burm.f.	Asphodela- ceae	tree	Roots	Soaked with alco- hol	Sexual performance	0.30	2012; Lamxay, Boer, and Björk 2011; Li and Xing 2016; Mi et al. 2021)
ແຄລາ ວ	Fernandoa adenophylla (G.Don) Steenis.	Bignonia- ceae	tree	Roots	Boiled	Stomach prob- lem	0.03	(Sajeesh, Arunachalam, and Parimelazhagan 2011; Gupta et al. 2014)
ດອກຟອນ	Buddleja asi- atica Lour.	Buddleja- ceae	shrub	Roots	Boiled	Health tonic, Cough	0.05	
ໝາກຂາມເດືອນ	Roureopsis stenopetala (Griff.) Schel- lenb.	Connaraceae	liana	Stems	Soaked with alco- hol/boiled	Health tonic	0.10	(Elkington et al. 2014; Dubost et al. 2019)
ຫົວເອື້ອງ ນາ	Costus speciosus (J.König) Sm.	Costaceae	shrub	Stems	Boiled	Kidney problem	0.02	
ກະແດ	calycopteris floribunda (Roxn.) lamk.	Combreta- ceae	shrub	Roots, Leaf, Fruits	Boiled	Fever	0.02	(Xuqiang Liu et al., n.d.; Effects 2007; Arora et al. 2011)
ໝາກແກ	Combretum quadrangulare Kurz		Liana	Stems, Leaf	Crushing	Rash on body/ anti-allergy.	0.05	
ແສນເມືອງ	Gonocaryum lobbianum (Miers) Kurz	Cardiopteri- daceae	shrub	Stems	Soaked with cold water	Jaundice	0.02	(Anyanwu et al. 2017; Omokhua et al. 2015; S Kumar et al. 2017)
ຫຍ້າຄົມ ປາວ	Scleria levis Retz	Cyperaceae	grass	Roots	Boiled	Kidney problem	0.02	
ກັກຕາໄກ	Salacia chin- ensis L	Celastraceae	shrub	Stems, Leaf	Crushing	Crushing	0.06	(S Kumar et al. 2017; Christaki and Florou-paneri 2015; Tugume and Nyakoojo 2019)
ໄມ້ຟອກ	Parinari ana- mensis Hance	Chrysobala- naceae	tree	Roots	Boiled	Stomach prob- lem	0.05	
ແຄນຫົນ	Hopea ferrea Pierre	Dipterocar- paceae	tree	Barks	Soaked with cold water/ boiled	Alleviating diarrhea	0.06	(Mi et al. 2021)
ໄມ້ແພງ	Dillenia pentagyna Roxb		tree	Roots	Soaked with cold water	Fever	0.60	
ໄມ້ໝາກ ສິ້ນ	Dillenia indi- ca L.	Dilleniaceae	tree	Roots	Boiled	Liver disease	0.02	(Samatha et al. 2012; Dinda et al. 2015; Satyaeswari 2018)

ໝາກຈັບ	Diospyros decandra Lour	Ebenaceae	tree	Roots	Soaked with alcohol/boiled	Health tonic	0.03	
ໄມ້ສັ້ນ	Elaeocarpus stipularis Blume	Elaeocarpaceae	tree	Roots	Boiled	Menstrual cycle	0.02	(Khan 2013)
ຫຼໍ່ຊ້າງ	Macaranga triloba (Blume) Müll. Arg.		Shrub	Leaf	Boiled	Stomach problem	0.04	
ໝາກເຍົາ	Jatropha curcas L.	Euphorbiaceae	tree	Stems, Leaf	Crushing	Skin disease	0.01	(Khonkayan, Saengsiri, and Thipsontae 2019; Kranrod et al. 2019)
ປື້ນາທອງ	Croton lachnocarpus Benth.		shrub	Roots	Boiled	Kidney problem	0.27	
ໝາກຄ່າງ	Croton tiglium L.		shrub	Whole plant	-	Nervous, Cough	0.02	(Momin and Tripathi 2018; Thomas et al. 0.37)
ຂາມປ້ອມ	Phyllanthus emblica L.		tree	Roots, Leaf, Fruits	Boiled/raw eaten	Stomach problem	0.37	
ໝາກຄາຍຕັ້ງໂທມ	Mallotus philipensis (Lam.) Müll. Arg.		Shrub	Leaf, Bark	Boiled	Health tonic	0.02	(Rani et al. 2011; Parthasarathy, Vivek, and Anil, n.d.)
ໄມ້ແດງ	Xylia xylocarpa var. kerrii (Craib & Hutch.) I.C.Nielsen		tree	Roots	Soaked with cold water	Postpartum tonic	0.45	
ໜອນໜາຍ	Desmodium triquetrum (L.) DC.		shrub	Roots	Boiled	Liver disease, Nervous	0.02	(Rajiv Roy, Raj K Singh, Shyamal K Jash, Atasi Sarkar 2014; Natachit, Santiarvorn, and Khantawa 2006; Park et al. 2020)
ຕານສະຝາງ	Peltophorum dasyrachis (Miq.) Kurz	Fabaceae	tree	Barks	Boiled	Sexual performance	0.19	

ໝາກຫຸ່ນ	<i>Albizia corniculata</i> (Lour.) Druce		tree	Roots	Crushing/ Rubbed	Skin disease	0.02	(Huong, Hop, and Vu 2020; Panyaphu et al. 2011; De Boer, Lamxay, and Björk 2012; Boer, Lamxay, and Björk 2011; Lamxay, Boer, and Björk 2011)
ໝາກກະຈາຍ	<i>Caesalpinia digyna</i> Rottler.		Liana	Stems	Boiled	Diarrhoea	0.09	
ເກືອຈານ	<i>Spatholobus parviflorus</i> (DC.) Kuntze		liana	Stems	Boiled	Sore throat	0.02	(Li and Xing 2016; Island et al. 2013)
ໝາກຂາມ	<i>Tamarindus indicus</i> L.		tree	Barks	Powder	Wound infection	0.27	
ແຄຂາວ	<i>Sesbania grandiflora</i> (L.) Poir.		tree	Roots,	Boiled	Stomach problem	0.02	(Khonkayan, Saengsiri, and Thipsontae 2019; Ghadage et al. 2017)
ຂີ້ເຫຼັກ	<i>Senna siamea</i> (Lam.) Irwin & Barneby		tree	Stems, Leaf	Boiled	Sleeping pill	0.12	
ກູ່ດູ່ນຮຸ່ງ	<i>Helminthostachys zeylanica</i> (L.) Hook.	Helminthostachyaceae	Fern	Roots	Boiled	Stomach problem	0.02	(Sothearith et al. 2021; Sydara, Goodsmith, and Angeles 2014; Garcia 2021)
ຕູ້ວເຫືອງ	<i>Cratoxylum cochinchinense</i> (Lour.) Blume.	Hypericaceae	tree	Stems	Soaked with alcohol/boiled	Health tonic	0.93	
ຜັກອັດ	<i>Ocimum americanum</i> L.	Lamiaceae	shrub	Stems	Boiled	Stomach problem	0.02	(De Boer, Lamxay, and Björk 2012)
ຫຍ້າໝວດແມວ	<i>Orthosiphon aristatus</i> (Blume) Miq.		shrub	Whole plant	Boiled	Kidney problem	0.02	
ໄມ້ໝາກສາງ	<i>Litsea cubeba</i> (Lour.) Pers.	Lauraceae Juss.	tree	Whole plant	Boiled	Malaria, Dizzy	0.10	(Yazan et al. 2014; Yadav and Mishra 2015)
ຈວງສະນຸ່ງ	<i>Cinnamomum iners</i> Bl.		tree	Stems	Boiled	Sexual performance	0.02	
ໄມ້ເປືອຍ	<i>Lagerstroemia floribunda</i> Jack	Lythraceae	tree	Barks	Soaked with cold water	Diarrhea	0.05	(Gandhi and Mehta 2013; R. Article 2012; Sunil Kumar, Kumar, and Prakash 2011)

ໄຟລາງ	Eriolaenacandollei Wall.	Malvaceae	tree	Roots	Boiled	Stomach problem	0.16	
ເຄື່ອນແຫຼມ	Coscinium fenestratum (Gaertn.) Colebr.	Menispermaceae	liana	Roots	Boiled	Gastrointestinal	0.44	(Sothearith et al. 2021)
ເຄື່ອນຂີ້ງາຮ	Tinospora crispa (L.) Hook.f. & Thomson		liana	Stems	Boiled	Scabies, ringworm	0.02	
ເຄື່ອນຂີ້ນ	Ficus hirta Vahl	Ficus hirta Vahl	shrub	Roots	Boiled	Health tonic, Nervous	0.07	(Sothearith et al. 2021; Forest 1999; Island, Zheng, and Xing 2009; Li and Xing 2016)
ສມພ	Streblus asper Lour.		tree	Fruits	Soaked with warm water	Cough, Fever	0.08	
ເຄື່ອນຂີ້ປ່ອງ	Ficus hispida L.f.		tree	Stems	Boiled	Fever	0.02	(Sothearith et al. 2021; District, Regency, and Kalimantan 2019)
ກໍ່ງານຖົ່ນແດງ	Baeckea frutescens L.	Myrtaceae	tree	Fruits	Boiled	Alleviating jaundice	0.03	
ຊໍ່ງານຮາວ	Gomphia serrata (Gaertn.) Kanis	Ochanaceae	shrub	Stems	Boiled	Stomach problem	0.19	(Island et al. 2013; Li and Xing 2016; Prasad, Izam, and Khan 2018)
ໝາກເລື່ອງ	Averhoa carambola L.	Oxalidaceae	tree	Roots	Boiled	Kidney problem	0.05	(Sothearith et al. 2021)
ເຕືອນ	Pandanus tectorius Sol.	Pandanaceae	shrub	Leaf	Boiled	Nervous	0.02	
ກໍ່ງາປາ	Phyllanthus reticulatus Poir.	Phyllanthaceae	Shrub	Leaf	Soaked with cold water	Fever	0.29	
ຕໍ່ງາຕົ້ນ	Glochidion coccineum (Buch.-Ham.) Müll.Arg		Shrub	Whole plant	Boiled	Stomach problem	0.02	(Tsai, Tsai, and Chang 2004; Bu et al. 2011)
ເຄື່ອນຂີ້ຫົ່ນ	Coix lacryma-jobi L.		shrub	Fruits	Boiled	Kidney problem	0.02	
ຫຍ້າແຜກຫຍ້າ	Vetiveria zizanioides (L.) Nash	Poaceae	Grass	Roots	Boiled	Muscle aches	0.02	(Inta, Trisonthi, and Trisonthi 2013; Khonkayan, Saengsiri, and Thipsontae 2019; Sothearith et al. 2021)



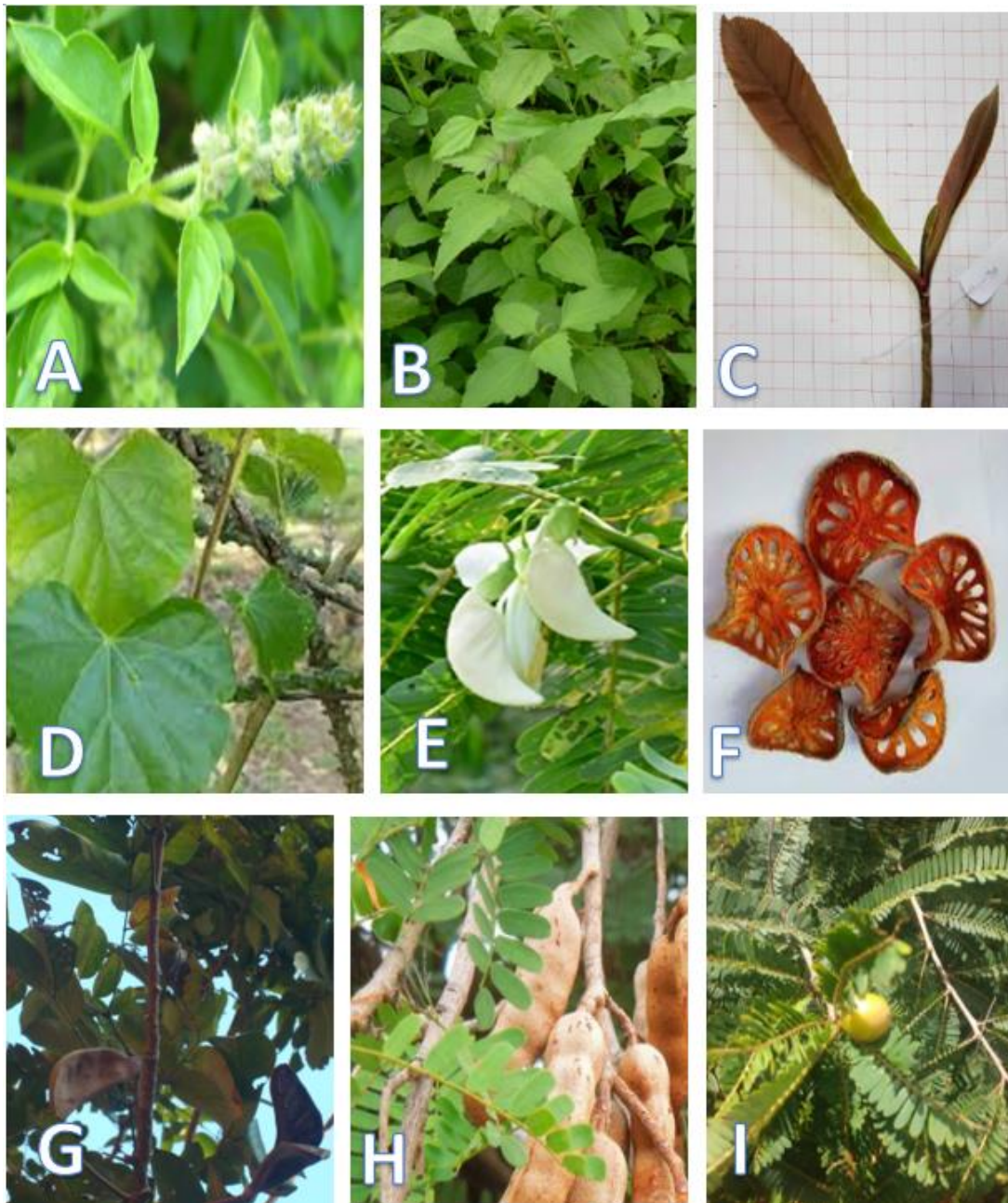
ກໍ່ຂາວ	<i>Haldina cordifolia</i> (Roxb.) Ridsdale		tree	Stems	Boiled	Stomach problem	0.29	
ຄໍດອຍ	<i>Oxyceros horridus</i> Lour.	Rubiaceae	tree	Leaf	Crushing	Wounds	0.04	(J. K. D. and K. Sharma 2014; Khonkayan, Saengsiri, and Thipsontae 2019)
ສົມມາກົບ	<i>Hymenodictyon orixense</i> (Roxb) Mabb		tree	Roots	Soaked with cold water	Fever	0.19	
ຊົມຊົນ	<i>Glycosmis pentaphylla</i> (Retz) Corr�ea.		liana	Stems	Boiled	Fever	0.14	(Khonkayan, Saengsiri, and Thipsontae 2019; Inta, Trisonthi, and Trisonthi 2013; Libman et al. 2006)
ປອນ	<i>Clausena excavata</i> Burm. f.	Rutaceae	Shrub	Stems	Boiled	Jaundice	0.02	
ໝາກຕູ້ມ	<i>Aegle marmelos</i> (L.) Cor�ea		tree	Fruits	Boiled	Postpartum tonic	0.45	(Dhanabal et al. 2016; Ma et al. 2011; Rodrigues 2017; Libman et al. 2006)
ກັກກນ	<i>Flacourtia indica</i> (Burm.f.) Merr.	Salicaceae	tree	Roots	Boiled	Stomach problem	0.05	
ນັງໂວ	<i>Scleropyrum pentandrum</i> (Dennst.) Mabb.	Santalaceae	tree	Roots	Soaked with cold water	Postpartum tonic	0.02	(Uddin et al. 2021)
ກັນທາ	<i>Harrisonia perforate</i> (Blanco) Merr	Simaroubaceae	shrub	Roots	Boiled	Stomach problem	0.03	
ຂົມເຟືອນ	<i>Brucea javanica</i> (L.) Merr.		shrub	Fruits	Boiled	Cholecystitis.	0.02	(Libman et al. 2006; Li and Xing 2016)
ຢາຫົວ	<i>Smilax glabra</i> Roxb	Smilacaceae	liana	Roots	Soaked with alcohol/boiled	Sexual performance	0.13	
ກັກຂີ້ດູນ	<i>Turpinia pomifera</i> (Roxb.) DC.	Staphyleaceae	tree	Leaf, Fruits	Crushing/powder	Heart Disease	0.02	(Che 2019; Uddin et al. 2021)
ຫາຍາວ	<i>Pterospermum lanceifolium</i> Roxb.	Sterculiaceae	tree	Stems	Boiled	Chest pain	0.02	

ຮູບຮ່າງ	Holoptelea intergrifolia Planch.	Ulmaceae	tree	Roots	Boiled	Liver disease	0.02	(Sothearith et al. 2021)
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### Use Value

The UV were high for plants with many use reports. Largely used medicinal plants included such as *Ocimum americanum* (0.93), *Cyathostemma micranthum* (0.79), *Dillenia pentagyna* (0.60), *Chromolaena odorata* (0.57), *Aegle marmelos* and *Xylia xylocar-*

*pa* (0.45), *Tinospora crispa* (0.44), *Phyllanthus emblica* (0.37), *Aloe vera* (0.30), *Sesbania grandiflora* and *Haldina cordifolia* (0.29), *Croton lachnocarpus* and *Tamarindus indicus* (0.27) etc. ‘‘Show detail in table 2 and Figure. 3’’



**Figure 3:** Selected medicinal plants its high used value: (A), *Ocimum americanum*, (B), *Chromolaena odorata*, (C), *Dillenia pentagyna*, (D), *Tinospora crispa*, (E), *Sesbania grandiflora*, (F), *Aegle marmelos*, (G), *Xylia xylocarpa*, (H), *Tamarindus indicus*, (I), *Phyllanthus emblica*.

## Medicinal Plant Knowledge

This study we found no difference in knowledge of medicinal plant between the male and female. The age basis, the youngest age group knew more medicinal plants (average 14.09 species) than did the middle age group (average 7.59 species). The oldest group knew the fewest (average 4.51 species). This study we found a relationship between age and number of medicinal plants know by Phouthai people, medicinal plants used increases with age. The younger people use more medicinal plants than older. Moreover, the linear regression between number of plants know by informants and informant age showed a significant positive relationship ( $R^2=0.0257$ ,  $F(1,129)=20.66$ ,  $P < 0.001$ ). Comparing the knowledge of medicinal plants between male (81) and female (69) by Chi-square statistics, t-test and analysis of variance, we found no differences in knowledge of the plants between gender.

## Indigenous knowledge for preservation and storage medicinal plants

The traditional healers and villagers usually collected the medicinal plants from different fields, such as in the forest, farmland, in and around their community. Plant parts used were dry and crouched before storing in bags or bottles. It's very difficult for pa-

tients to recognize plant species that are used for treatment, which sometimes seem like ordinary plants that were growing in gardens or in the forest. Almost traditional healers and villagers prefer to stored medicinal plants in dry or powdered form inside bottles or plastic bags to reduce the field collection trips and make sure the availability of plant parts is possible throughout the year.

Indigenous knowledge on processing and using medicinal plants The primary mode of preparation of plant extracts was boiling follow by soaking, and crushing (Table 3). Boiling were commonly used (68%), was prepared by boiling plant parts in a specific quantity of water for fifteen minutes and then mixture allowed to warm/cool before administration, followed by soaking with water (11%) that pouring down cool/warm water onto plant parts for one or two days and allowed the mixture. Soaking with alcohol (8%) involved pouring alcohol onto plant materials and allowed the mixture. Crushing was used (7%) of the plant species. Most, involved crushing plant materials of a single or combination of more than one part from different species to extract a liquid which was applying either topically. The mode preparation like powdering, raw eating, and rubbing was used with low frequency in the range of 6% of the plant species.

**Table 3: Mode of preparation plant parts used of identified species for treatments in and around Hinboun District Khammouan Province Lao P.D.R.**

No	Types of preparation	Frequency (%)
1	Boiling	60 (68)
2	Soaking with water	10 (11)
3	Soaking with alcohol	7 (8)
4	Crushing	6 (7)
5	Raw	3 (3)
6	Powder	2 (2)
7	Rubbed	1 (1)

## Discussion

The Phouthai people are a social group with characteristic culture transmitted from their antecedents. In their livelihood are interdependence between humans and naturals. Indigenous and knowledge become their identity. The lifestyle is combined base on traditional plant knowledge, belief's and exerting and error practices of the in and around communities which are passed on from parent to generation. Nowadays, indigenous plant knowledge is being increasing, this knowledge not only needs to be preserved in their communities but also need to documented [32]. Even more, some plants are used as important medicine and to make income for people in the communities. The highest number of medicinal plant species documented, and indicated that the study area has diverse tree used for treatment of disease. The number of medicinal plants documented was less than that of the studies reported elsewhere in Laos [33, 34]. But higher than H. J. DE Boer's study [35]. The plants were most frequently used for the treatment of the disease such as stomach problems, nervous system, kidney infection, liv-

er tonic, and postpartum tonic, which are consistent with other studies [36-38]. Moreover, the considerable number of traditional medicines were from roots, and this is because that roots were available throughout the year, and traditionally considered to be strong medicine with good smell and drinking easily [1, 3, 11, 39]. However, using of stems instead of roots, have been advocated by most ethnobotanical studies, as using roots highly affects the existence of medicinal plant species, as well as roots were not easily accessible and not sustainable [1, 17, 40, 39]. The most common mode of preparation was boiling. This result is consistent with the finding of [38, 33, 14, 12, 11]. Who documented that the principal mode of medicine preparation was through boiling. As other studies showed that most medicines was preparing from a mixture or combined plant materials, we also found this [41, 3, 42].

The medicines preparation modes of dominant treatments varied from diseases such as skin diseases preparing by smoke, crashing and burning, and most of the medicines prescribed were by tradi-

tional healers orally as they were easy to apply for human disease. In addition, some solvents such as water and alcohol were commonly believed to serve as the vehicle to transport the medicines, which is compatible with some other studies in Laos elsewhere and other tropical countries [12, 29, 43]. Villagers and healers know how to use medicinal plants mainly to treat common diseases, including stomachaches, fever, and wounds.

### Conclusion

In Hinboun district, Khammuoan province, Lao PDR, it was found that the total of 79 plant species were used for traditional medicine and documented as use in the treatment of different common sicknesses, including stomach problems (gastrointestinal, flatulence, diarrhea, detox), kidney infections, fever, dysmenorrheal postpartum tonic, nervous system, skin disease, health tonic, lever infections, heart disease, dressing wounds, and others. Most majority of these traditional medicinal plants were trees, shrubs, liana, and gasses, mainly from the wild. In terms of the parts of the plant, roots and stems were most frequently used. Usually, medicinal plants were dried and used for preparation by boiling, soaking with cold water or alcohol, crushing.

The current study also highlighted that realization and cultural beliefs have a significant influence on the unique source of health-care, in contrast, religion was found to have no association with health-seeking behavior. Beyond, the therapeutic use of the identified and documented plants will provide essential data for further researches focusing on pharmacological studies and the conservation of the most important medicinal plants in the study area. Health policies have to promote the utilization of medicinal plants as part of a strategy to improve the basic health and livelihoods of rural communities throughout the country. Further exploration is needed on the bioactive compound and chemical factor contents of medicinal plants.

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